ELECTRICAL TIMES

AEI

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BEAVERS
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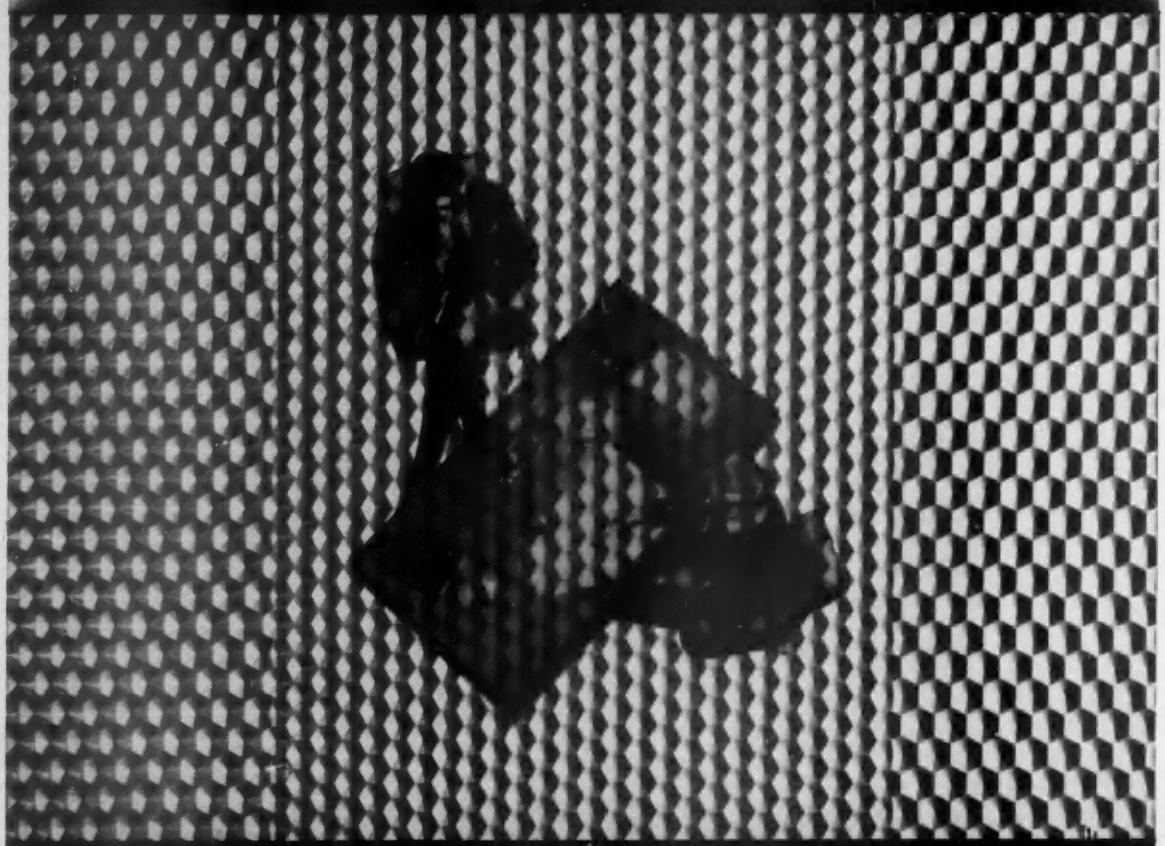
AEI CABLE DIVISION

IF FLUORESCENT TUBES COULD ONLY SEE . . .



they might find themselves peering down through this while their progeny, the little lumens, become white with heat. For confinement to precise lines of conduct is enough to make any lumen glow.
Holophane, through their scientific systems of prismatic control, bring to fluorescent lighting a unique approach where brightness is controlled and high utilization of light sources is achieved. Light is where you want it—on the working plane—and not in the eyes. Write for latest Holophane lighting catalogues, without obligation.

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INSTRUMENTS OF THE FUTURE *NOW* by AVO

NEW AVO TRANSISTOR ANALYSER

A portable battery-operated instrument, suitable for testing PNP, NPN and Point Contact transistors, in the grounded emitter configuration. Provision is included for *in situ* measurements. The instrument is supplied complete with comprehensive operating instructions, together with the AVO International Transistor Data Manual which provides test data for approximately 3000 transistors.

Brief Specification:

Range of Collector Voltage:	1·5V to 10·5V (up to 150V using external supplies)
I_{CO}:	First indication 2μA
Base Current:	0-1 mA, 0-40 mA
Collector Current:	0-1A
Beta:	0-25, 0-250 measured at 1 Kc/s
Noise Measurement:	1-20, 21-40 dB

Construction in general conforms with U.K. Inter-Service Spec. K114.

NEW AVO VALVE CHARACTERISTIC METER Mk. IV

This instrument has been designed to test any standard receiving or transmitting valve having up to a maximum anode dissipation of 25W. Inter-electrode insulation, anode current, mutual conductance and 'gas' current can be measured, and by making a series of tests, complete families of curves may be plotted. Rectifiers and signal diodes are tested under suitable load conditions. A comprehensive data manual is supplied with the instrument, which operates from 100-120 volts and 200-260 volts 50-60 c/s A.C. mains.

Brief Specification:

Range of Anode Voltage:	12·6 – 400 volts
Range of Screen Voltage:	12·6 – 300 volts
Range of Heater Voltage:	0·625 – 117·5
Heater Current:	3A max.
Anode Current:	100 mA max.
Mutual Conductance:	0·1 – 60 mA/V max.
Negative Grid Voltage:	0 – 100V in 9 ranges
'Gas' Current:	2μA first indication

REPAIR SERVICE

Our fully equipped Service Dept. deals promptly with repairs to AVO Instruments, or if more convenient they may be sent to either of the following authorised AVO Service Agents:—

Automac Ltd., Throstle Grove Works, Gt. Egerton Street, Stockport, Cheshire.

Farnell Instruments Ltd. Light Industrial Estate, York Road, Wetherby, Yorks.

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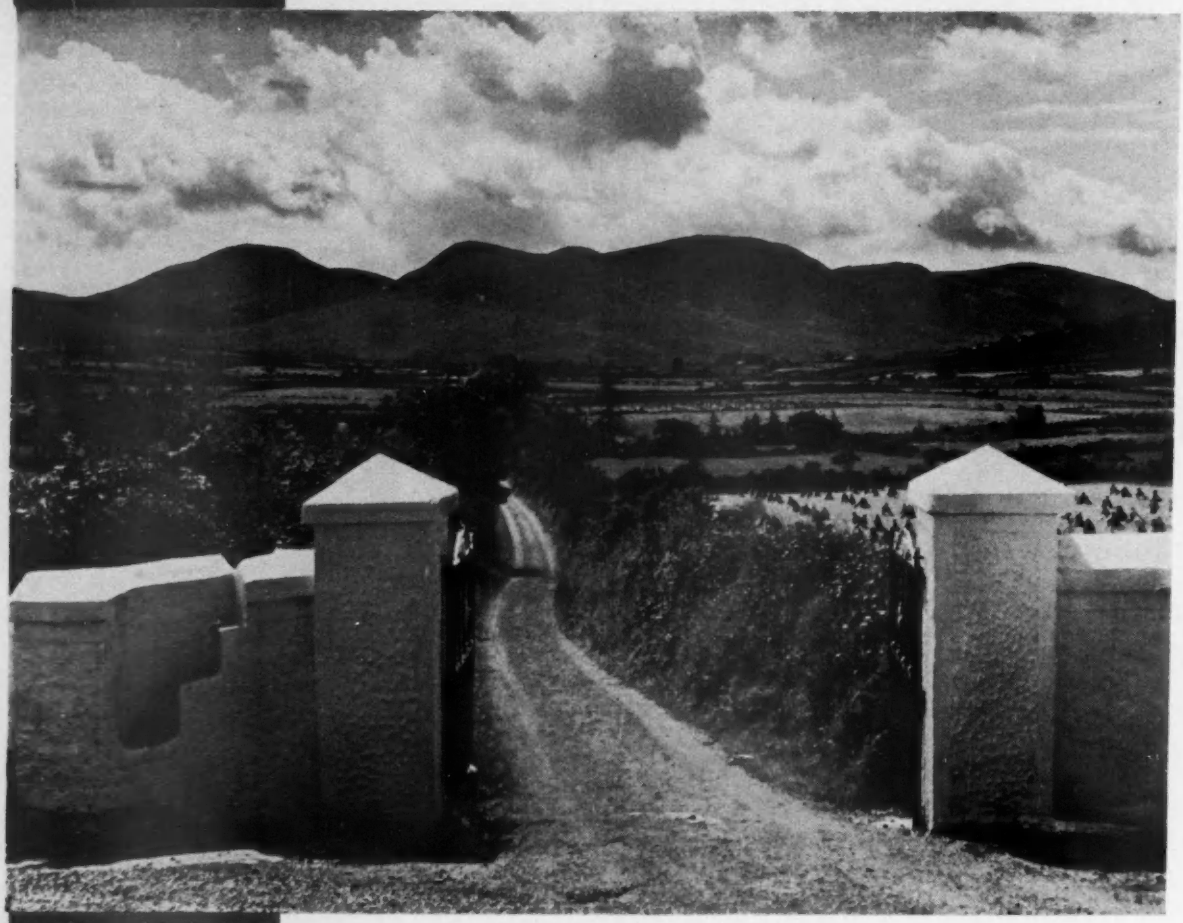
VC/TA2

'Tis distance lends enchantment to the view, And robes the mountain in its azure hue.

(Pleasures of Hope by Thomas Campbell)



By courtesy of Tourist Information Centre, Belfast

Irish cables are manufactured amidst scenery depicted above, showing the famous and beautiful Mourne Mountains.

IRISH CABLES will stand inspection right through to the very core, as a result of the high quality of materials used and constant vigilance and inspection throughout manufacture

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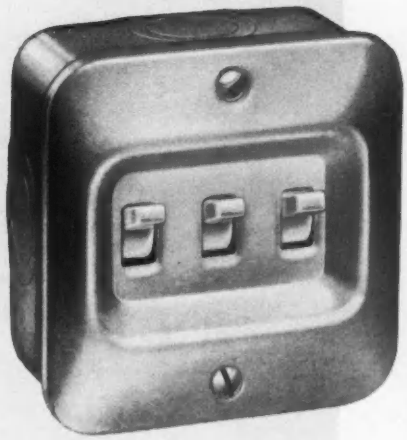

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- ✱ 3 sizes of box. Deep drawn, Dual knockouts
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- ✱ Maximum protection for switch dollies
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- ✱ Prices to please you

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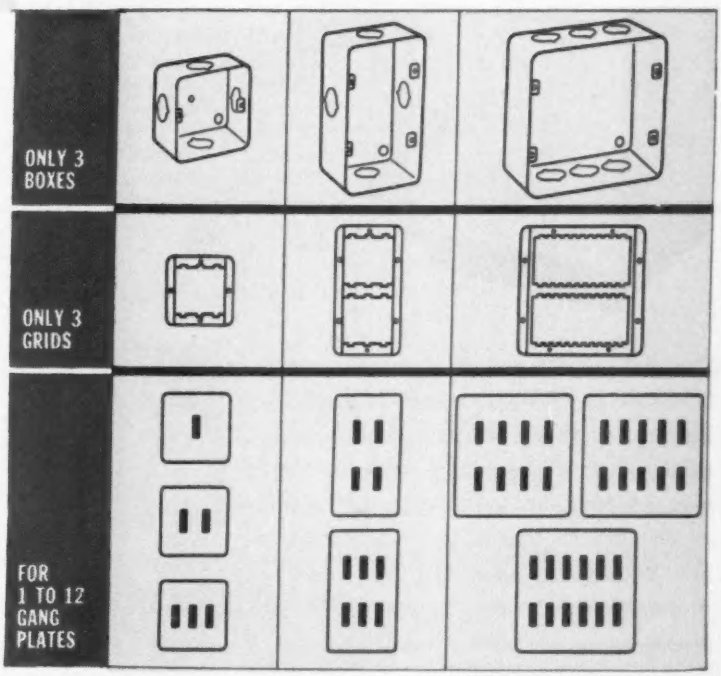
5 amp. double pole switch
5 amp. 2-way and off switch
5 amp. intermediate switch
5 amp. 1-way S.P. secret switch
5 amp. 2-way S.P. secret switch
Mains voltage bell push
Neon indicator



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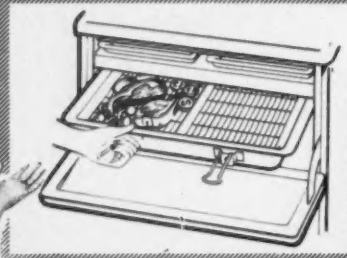
NO OTHER COOKER AT ANY PRICE HAS ALL THESE FEATURES

The Belling Classic 60 combines all the latest advances in efficient, labour-saving cooking with glamorous lines and luxury appearance. Double-width grill with separate controls for each half, independently-heated hotcupboard, indicator lights on all controls, four simmerstat-controlled radiant plates with easy-clean drip-trays, removable oven roof and lining, wheels in the base with automatic brake—these are a few of the special features which make this the most exciting cooker on the market.



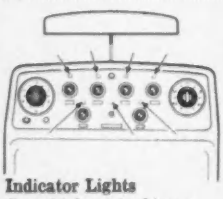
"Double" Grill
New independent full-width grill takes full mixed grill for the whole family. Special economy control enables half or whole grill to be used.

Four Fast Radiant Plates
with Simmerstat controls.

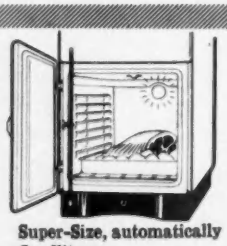
Large Independently-heated Hotcupboard
with Drop-down door.

Slide-Out Oven Roof
and removable one-piece lining for very easy cleaning.

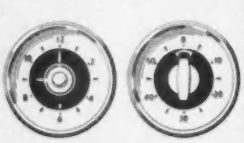
Wheels for easy moving
with automatic brake.



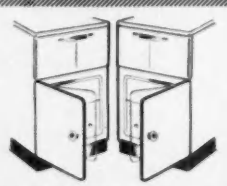
Indicator Lights
See which control is on —at a glance!



Super-Size, automatically floodlit oven



Easy-set Auto-Timer
combined with electric clock—ringing timer too.



Reversible Oven Doors
Right or left hand opening.

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CLASSIC SIXTY £69.10.0.

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A METRAC LIVE LINE INDICATOR TAKES THE RISK OUT OF MAINTENANCE WORK

"DANGER LIVE"—the Metrac Live Line Indicator, for verifying the isolation of high voltage apparatus before working on it, gives a clear reading on an illuminated scale in the presence of an energised conductor. The Metrac is a one-hand instrument, weighing less than 2lbs., containing its own batteries. The model illustrated is designed for use on 33 to 275kV overhead lines, while a switchgear spout model is made for testing 22 to 66kV metalclad switchgear. No contact is made with the conductor as the instrument detects the electrostatic field set up by a conductor energised by an A.C. voltage. Use is not confined to overhead lines and switchgear —a Metrac should be on hand in all work involving high voltage system.

Sheet 255b gives the technical details

Please send for your copy.

Other Products include : Timers · Synclock Motors · Metrohm · Metrans · Battery Charge Indicators · Recorders

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"HIDUTAC" switchfuses for

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30 amp

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now available from stock

15, 30 or 60 amp. 440 volt a.c. Single Pole and Neutral, Double Pole, Triple Pole, Triple Pole and Neutral Switchfuses with interchangeable H.R.C. or rewirable fuses.

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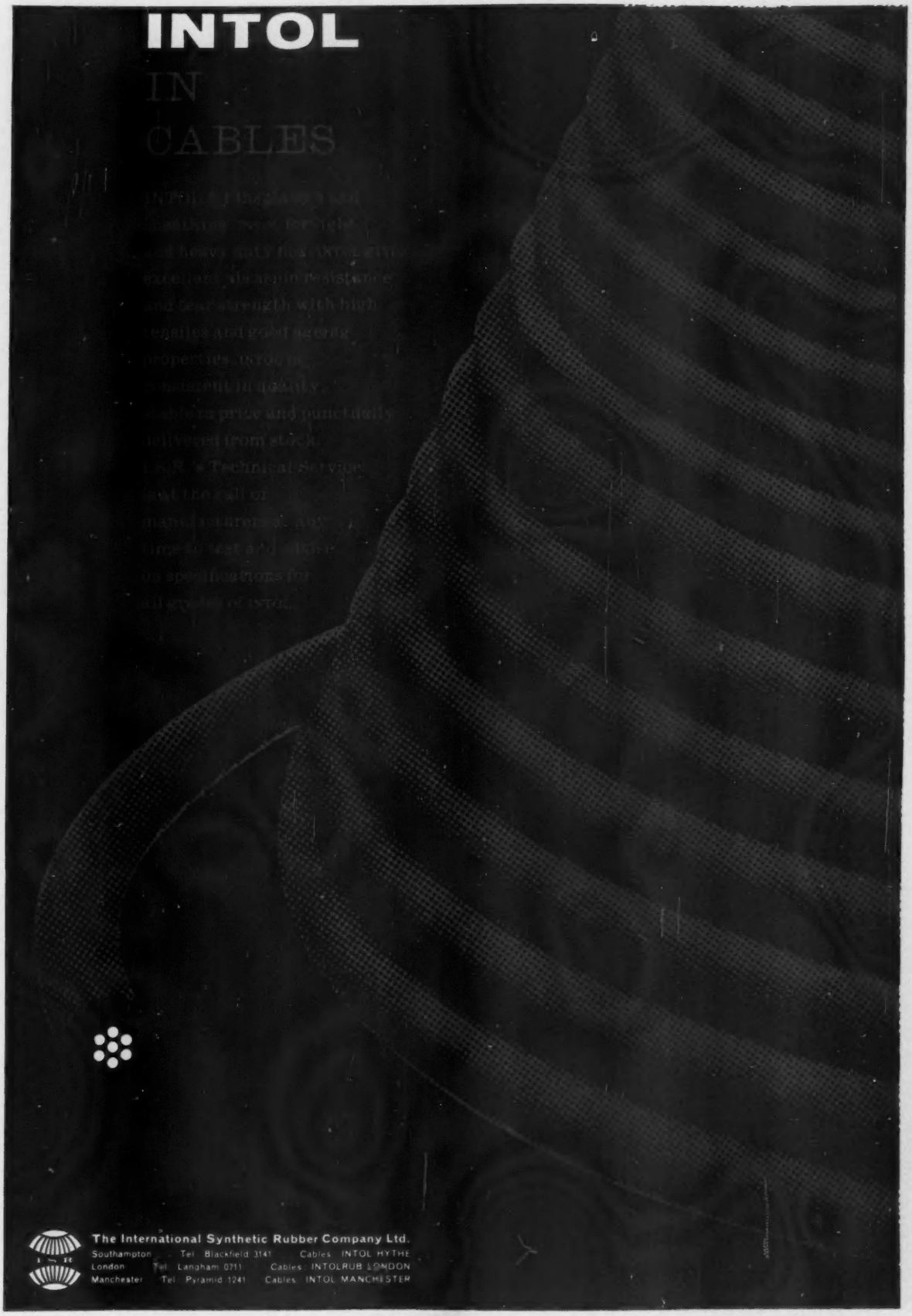
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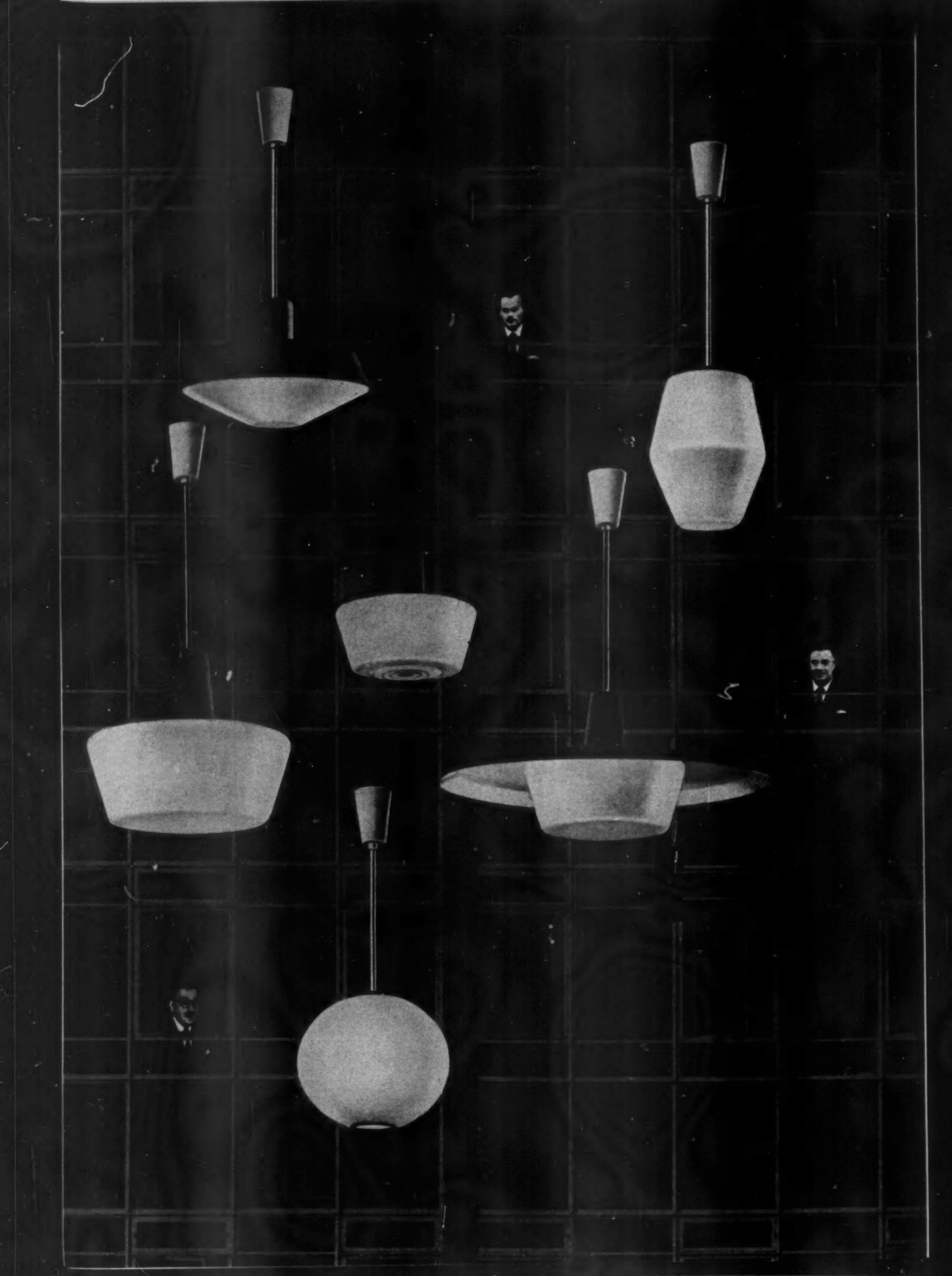
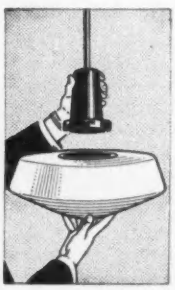


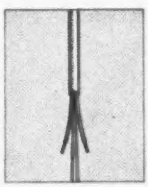
EXECUTIVE...

A new range of commercial lighting fittings, pendant and ceiling type, offering a wide choice of glasses, reflectors, skirts and suspensions, based on a quite small number of standard components. This is **EXECUTIVE** lighting, elegant, versatile and easy to maintain. Particularly suitable for offices, shops and stores, schools and public buildings.



New simple 'TURN and LOWER' action for easiest ever installation and maintenance.

G.E.C's new positive bayonet fixing with 'turn and lower' action means EXECUTIVE glasses can be fixed or removed in an instant, saving time and money on maintenance and lamp replacement. (Patent applied for).



EXECUTIVE suspensions in ten different lengths are either ½ in. silver anodised aluminium tube or this new steel reinforced white flexible. (Patent applied for).

Internal locking screw on lampholder prevents unscrewing when relamping.

EXECUTIVE

by G.E.C.

LIGHTING & HEATING GROUP, THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

HERE IS MAGIFLOW — the latest newcomer to Berry's famous 'Magi' range of electrical appliances.

Trim good looks and top efficiency make the Magiflow the water heater more and more people are going to ask for. Its sleek design takes up less than a square foot of wall space — yet Magiflow can supply more than enough piping hot water for any average family, thanks to its exceptionally quick recovery.

First class insulation and "magic eye" thermostatic control cut running costs to the absolute minimum. Check all the Magiflow's features and see why *this* is the water heater you should recommend.

Capacity: 1 gallon.
Voltage: 200-250 V.
Loading: 2 kW at 250 V. 1.5 kW at 200 V.
Size: [redacted] 8" projection.
Finish: White or cream, chromium fittings, black, easy-to-clean, toughened plastic tap.

The Magiflow complies with B.B.S. 843 and 1010.

£10.16.6 plus P.T. £2.2.3

PRICE: £12 . 18 . 9

Berry's

BERRY'S ELECTRIC MAGICOAL LTD.

Water Heater Division · Touchbutton House · Newman Street · London W.1. Tel: MUSeum 6800

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Telecommunication equipment
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Radar and navigational aids
Measuring instruments and scientific apparatus
Medical electronic and allied apparatus
Process control and automation equipment
Civil and military aeronautical purposes
Guided missiles and military equipment

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OLYMPIA · LONDON
30 MAY – 2 JUNE 1961

10 a.m.—6 p.m. daily except
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Admission: 5/- or by ticket obtainable from exhibitors.

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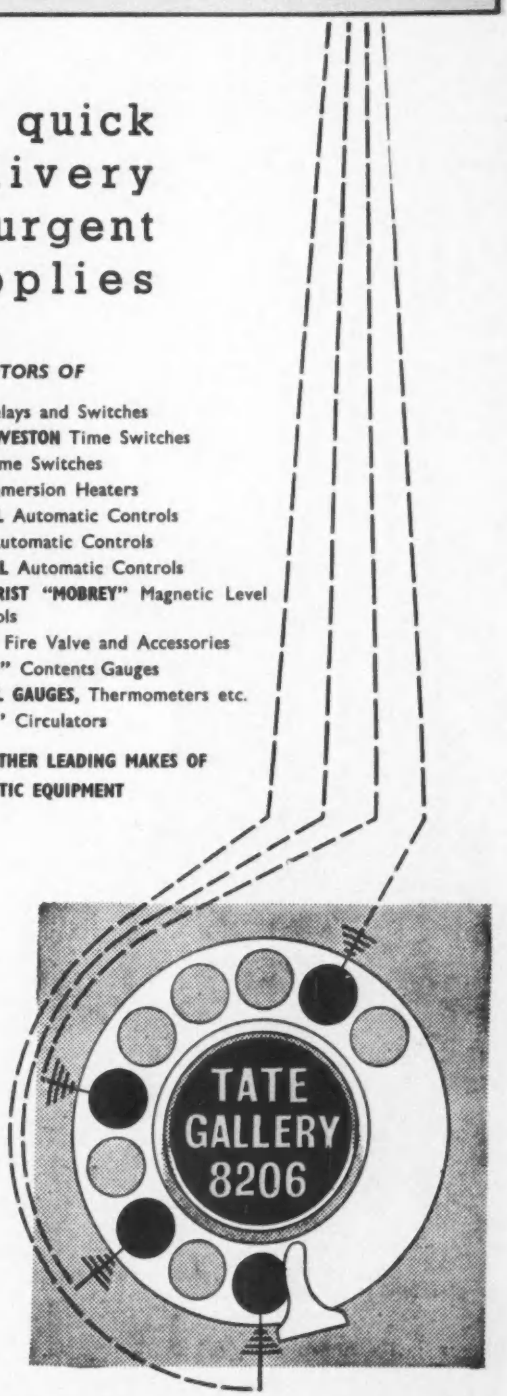
AND ALL OTHER LEADING MAKES OF THERMOSTATIC EQUIPMENT



GRANVILLE
engineering company
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They take it for granted

How the chores have been taken in hand! In bygone days there was time (or servants) to warm the bed or hot up the flat-iron. Now electrically we make the tea and coffee, dry our hair, heat our floors and our food; even bathe ourselves with infra-red rays.

At British Driver-Harris we are glad to play our part in this domestic emancipation—even though our particular contribution is generally taken for granted. That, as a matter of fact, suits us very well. Heating elements, for example, are doing their job perfectly when nobody needs to notice them. The Nichrome* series of nickel-containing electrical resistance alloys is famous throughout the world for long trouble-free life at high temperatures.

* *Regd Trade Mark*

"Electrical Alloy Data" contains 84 pages of fundamental information concerning the use of electrical resistance alloys. Copies are available free of charge on request.

*NICHROME** and *NICHROME*V*
for heating elements
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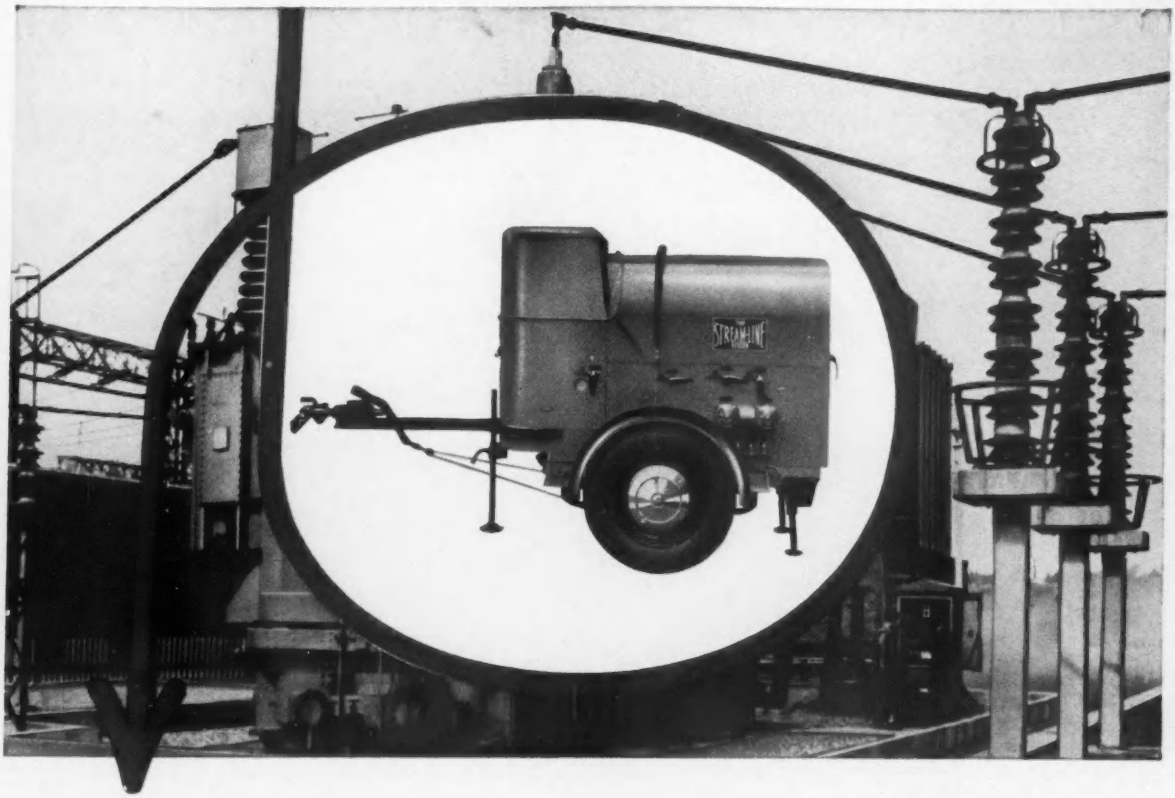
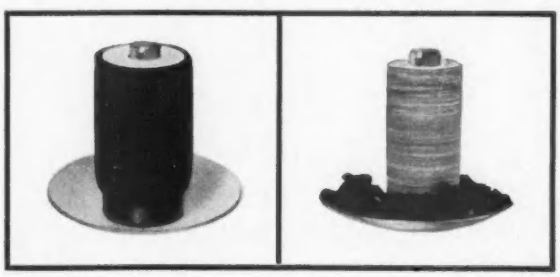


Loop in a Stream-Line filter



These illustrations show the Stream-Line filtering element built up of special paper discs under end pressure. Oil passes through the infinitesimal interstices between the discs leaving solid impurities at the paper edges. Instantaneous cleaning is carried out by a reverse flow of compressed air.

The security of oil-immersed circuit-breakers and transformers depends on the condition of the insulating oil, for if it contains impurities and moisture a serious loss of insulating protection will occur. The Stream-Line filter, embodying filtering elements, heating chamber and vacuum receiver, is the most perfect practical safeguard against this happening. A *single* passage of oil through a Stream-Line filter ensures the elimination of *all* solid impurities including the finest colloidal carbon. In addition, dehydration and de-aeration ensure the removal of all free and dissolved water and gases—*and the filtered oil will have a dielectric strength far above that specified for new oil.*

HIGH VACUUM

The standard Stream-Line filters, working at moderate vacuum, are fully adequate for most requirements but in order to cater for exceptional cases models are also available to operate under high vacuum. Treatment under conditions approaching absolute vacuum, combined with the unique Stream-Line edge-filtration principle, gives results with regard to the elimination of the last traces of air and moisture which are quite remarkable. Send us particulars of *your* special requirements.

STREAM-LINE

STREAM-LINE FILTERS LIMITED
HENLEY PARK, NORMANDY, NR. GUILDFORD, SURREY

Telephone: Normandy (Surrey) 3311-3 Telegrams: Edgefilt, Guildford

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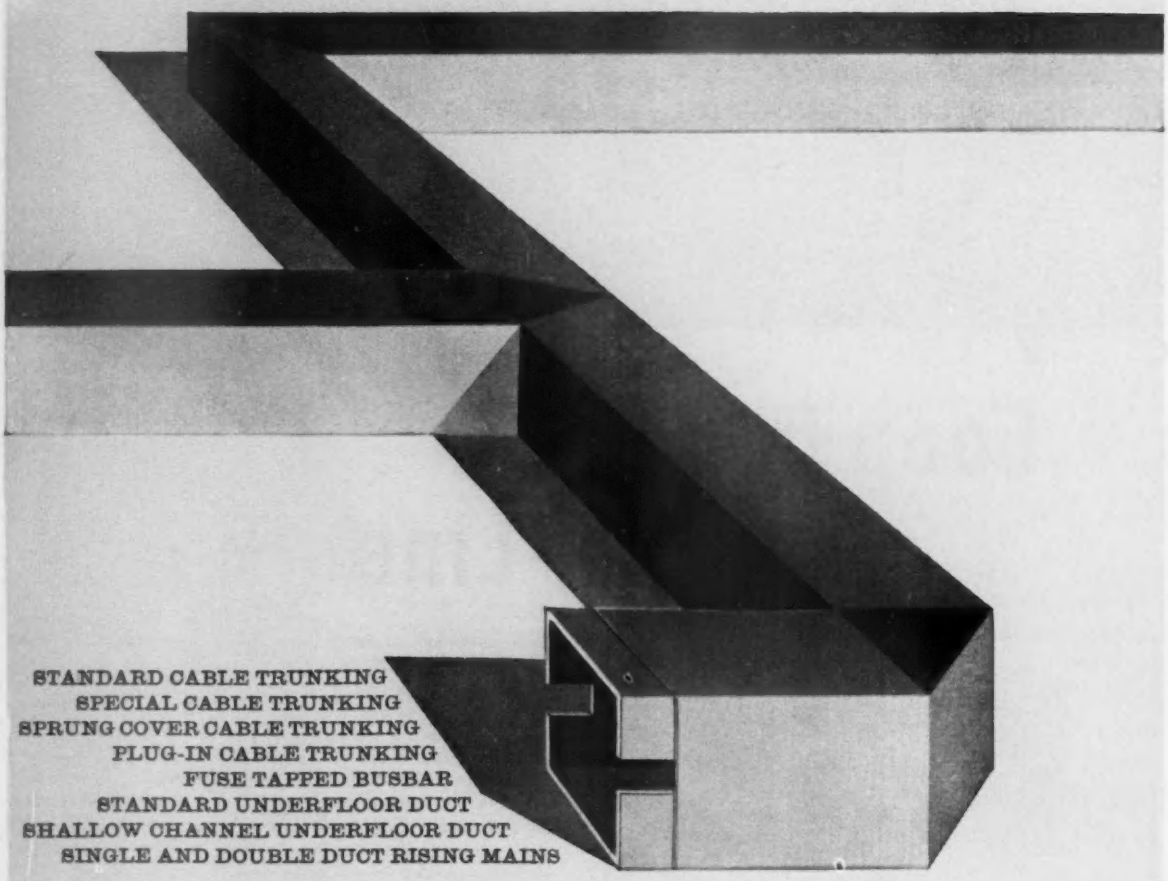

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FUSE TAPPED BUSBAR
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SHALLOW CHANNEL UNDERFLOOR DUCT
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Complete schemes and designs can be prepared without obligation to meet specific requirements of architects, consulting engineers and electrical contractors.

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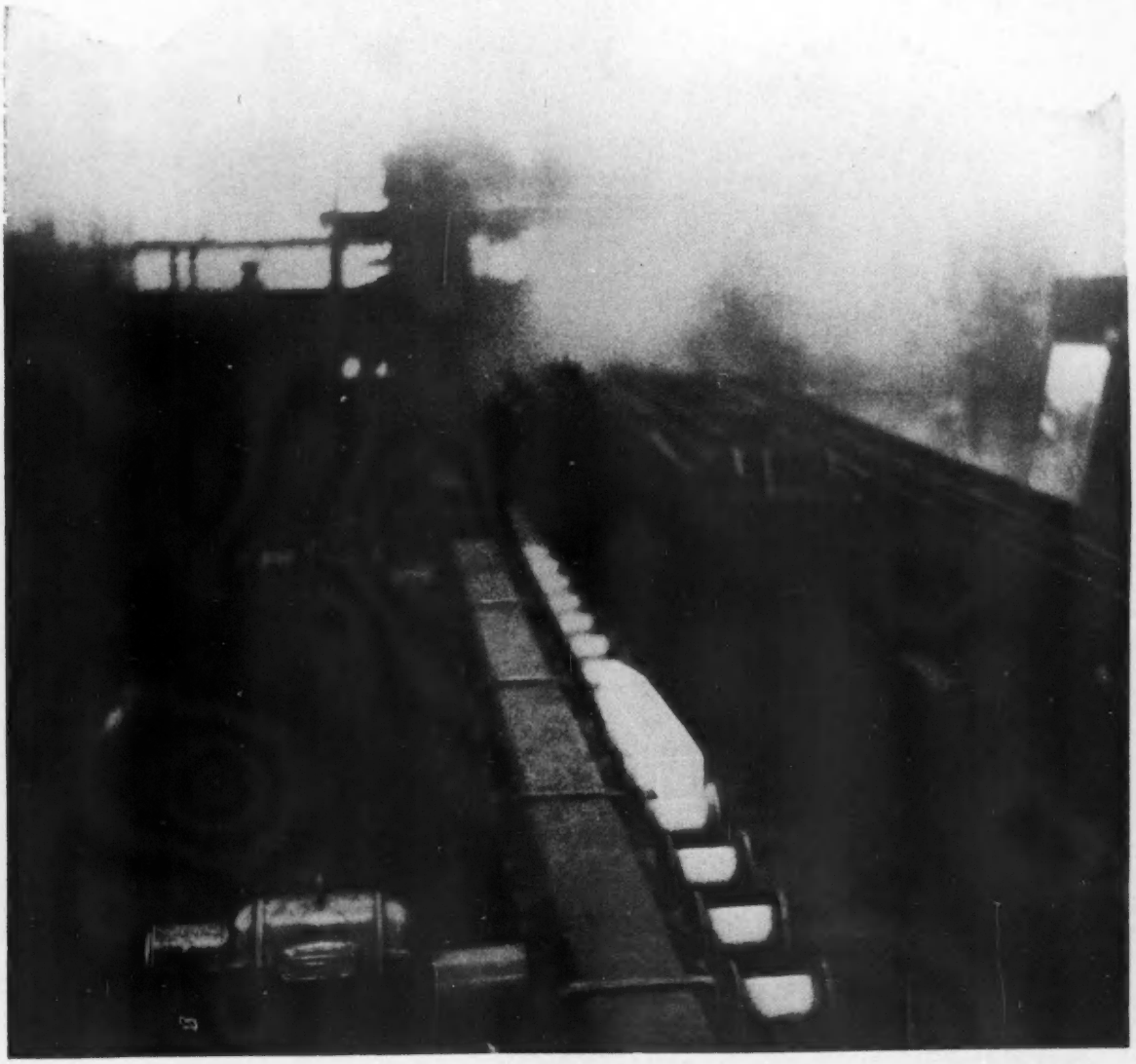
HOT WORKING COPPER

The first stage in the manufacture of a wrought copper product consists of hot working a casting.

The wire bars used for hot rolling are of various selected qualities and are channelled carefully into the appropriate finished form.

We have been hot rolling copper for many years and have three separate mills for the process.



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WHICH WAY WOULD YOU TAKE THE PYLONS?

Down in the valley, the town needs more power. The time's come to bring in a power line from the Grid. That means pylons, right across these fields, and on down into the valley.

There are perhaps a hundred paths the pylons could follow. *One* must be chosen. Not plotted arbitrarily across a map, but thoughtfully, carefully sited, so that pylons and cable strike the best possible balance with the landscape.

The Central Electricity Generating Board are just as concerned about this as they are about bringing in the power. For the nation has charged the Board with a double duty. Not only to maintain an efficient, economical electricity supply, but also to preserve the amenities of the country as they go.

That's why the new line will be planned so that it follows the dark background of a wood here; skirts a village there; crosses skylines in the most inconspicuous way to be found; and eventually reaches the town through its industrial suburbs.

These advertisements are appearing in the farming and country magazines. The Central Electricity Generating Board thank electrical contractors for their co-operation in the past, and know that they will do all they can to preserve the amenities of the countryside.

THE CENTRAL ELECTRICITY GENERATING BOARD CEGB

NEWS SHEET

Faults on 132 kV system shut down SE England on Monday evening. Cascade tripping follows one or more earth faults. 275 kV system not affected. 2½ hour interruption in some areas. (807)

NCB chairman says Board will aim for long-term fixed-price contracts for coal. NCB should not regard electricity supply as a captive customer. Pit mechanisation extending fast. (780, 802)

Britain's industrial prestige on show in Moscow. Soviet engineers see technological advances in British Trade Fair which BoT president opens on Friday. 621 firms, 48 electrical, are showing equipment from mobile generating sets to consumer goods on 228,000 sq ft site. (779, 787)

Low consumption claims for off-peak electrical heating confirmed by HVRA investigations. Solid fuel and oil boilers less efficient than had been thought and more heat gains from miscellaneous sources, less ventilation loss, better thermal insulation in heated buildings. (779, 803)

Eastern EB abolish domestic floor area basis for fixed charge, now 1s 11d a week f.c. for all dwellings. Unit price raised ¼d to 1½d. Industrial m.d. charges up 1s. (807)

Ultra-thin metal films developed for high-speed counting, shown at Royal Society conversazione. Other exhibits demonstrate stabilising of cylindrical structures against wind-induced vibrations. Sensitivity of plant roots to distorted growth in magnetic fields confirmed. (784)

Duke of Edinburgh opens McFadzean laboratories; BICC facilities include miniature paper-making machine for research into e.h.v. cable papers. Development of non-destructive tests and automatic manufacturing techniques a major part of work. (785)

Thorn Electrical acquire Ultra Holdings but will preserve Ultra and Pilot working and marketing units with management largely unchanged. Thorn's now the largest group in radio industry. (810)

PEOPLE—J. H. Thornton is construction group resident superintendent, Sizewell nuclear power station . . . new LEB district engineers are C. G. Kirkwood (East End) and N. L. W. Hills (Eastern) who succeeds H. A. Phillips (retired) . . . R. Dell becomes chief signal engineer, and W. H. Challis signal engineer, London Transport . . . Lord Gridley to relinquish chairmanship, Southern Areas Electric Corpn. . . . W. A. Gibson promoted to Manweb establishments officer . . . G. Wibrow joining HVE (Electric) as Southern area manager . . . In further Marconi changes F. Wheeler becomes commercial manager and H. Baker deputy commercial manager, with F. S. Mockford on special duties . . . W. N. C. Clinch retires. (792, 794)

WHICH WAY WOULD YOU TAKE THE PYLONS?

Down in the valley, the town needs more power. The time's come to bring in a power line from the Grid. That means pylons, right across these fields, and on down into the valley.

There are perhaps a hundred paths the pylons could follow. *One* must be chosen. Not plotted arbitrarily across a map, but thoughtfully, carefully sited, so that pylons and cable strike the best possible balance with the landscape.

The Central Electricity Generating Board are just as concerned about this as they are about bringing in the power. For the nation has charged the Board with a double duty. Not only to maintain an efficient, economical electricity supply, but also to preserve the amenities of the country as they go.

That's why the new line will be planned so that it follows the dark background of a wood here; skirts a village there; crosses skylines in the most inconspicuous way to be found; and eventually reaches the town through its industrial suburbs.

These advertisements are appearing in the farming and country magazines. The Central Electricity Generating Board thank electrical contractors for their co-operation in the past, and know that they will do all they can to preserve the amenities of the countryside.

THE CENTRAL ELECTRICITY GENERATING BOARD

NEWS SHEET

Faults on 132 kV system shut down SE England on Monday evening. Cascade tripping follows one or more earth faults. 275 kV system not affected. 2½ hour interruption in some areas. (807)

NCB chairman says Board will aim for long-term fixed-price contracts for coal. NCB should not regard electricity supply as a captive customer. Pit mechanisation extending fast. (780, 802)

Britain's industrial prestige on show in Moscow. Soviet engineers see technological advances in British Trade Fair which BoT president opens on Friday. 621 firms, 48 electrical, are showing equipment from mobile generating sets to consumer goods on 228,000 sq ft site. (779, 787)

Low consumption claims for off-peak electrical heating confirmed by HVRA investigations. Solid fuel and oil boilers less efficient than had been thought and more heat gains from miscellaneous sources, less ventilation loss, better thermal insulation in heated buildings. (779, 803)

Eastern EB abolish domestic floor area basis for fixed charge, now 1s 11d a week f.c. for all dwellings. Unit price raised ¼d to 1½d. Industrial m.d. charges up 1s. (807)

Ultra-thin metal films developed for high-speed counting, shown at Royal Society conversazione. Other exhibits demonstrate stabilising of cylindrical structures against wind-induced vibrations. Sensitivity of plant roots to distorted growth in magnetic fields confirmed. (784)

Duke of Edinburgh opens McFadzean laboratories; BICC facilities include miniature paper-making machine for research into e.h.v. cable papers. Development of non-destructive tests and automatic manufacturing techniques a major part of work. (785)

Thorn Electrical acquire Ultra Holdings but will preserve Ultra and Pilot working and marketing units with management largely unchanged. Thorn's now the largest group in radio industry. (810)

PEOPLE—J. H. Thornton is construction group resident superintendent, Sizewell nuclear power station . . . new LEB district engineers are C. G. Kirkwood (East End) and N. L. W. Hills (Eastern) who succeeds H. A. Phillips (retired) . . . R. Dell becomes chief signal engineer, and W. H. Challis signal engineer, London Transport . . . Lord Gridley to relinquish chairmanship, Southern Areas Electric Corpn. . . . W. A. Gibson promoted to Manweb establishments officer . . . G. Wibrow joining HVE (Electric) as Southern area manager . . . In further Marconi changes F. Wheeler becomes commercial manager and H. Baker deputy commercial manager, with F. S. Mockford on special duties . . . W. N. C. Clinch retires. (792, 794)

NEWS SHEET

Printed circuit components enter power field giving reduced costs and assembly time. Uses include auxiliary switch for on-load tap-changer, aircraft de-icing resistors and a small motor. (781)

Van de Graaf generator and experimental nuclear reactor for NPL to be housed in now vacant h.v. building. Visitors on open day see high-pressure physics developments and new standard for international metre. (791)

Double insulation offers safety advantages for industrial portable tools but Factory Act regulations prohibit use without earthing outer metal. (780, 795)

New Zealand policy to delay base load steam stations as long as possible. Official report bases plans up to 1970 on hydro development with inter-island connection; 2,886 MW capacity by 1969/70. (815)

Housewives offered sales commission on gas appliances by N.W. Gas Board. Members of Women's Gas Federation will get same reward as Board's employees, conference told. (807)

Early-1962 target date for Consumer Protection Committee report, Government not to ask for interim reports. (808)

NICEIC tests show 4% inspected installations have faulty earthing. Progress reported with correct observance of Reg. 207 G, on enclosure of wiring connections to accessories and apparatus. (807)

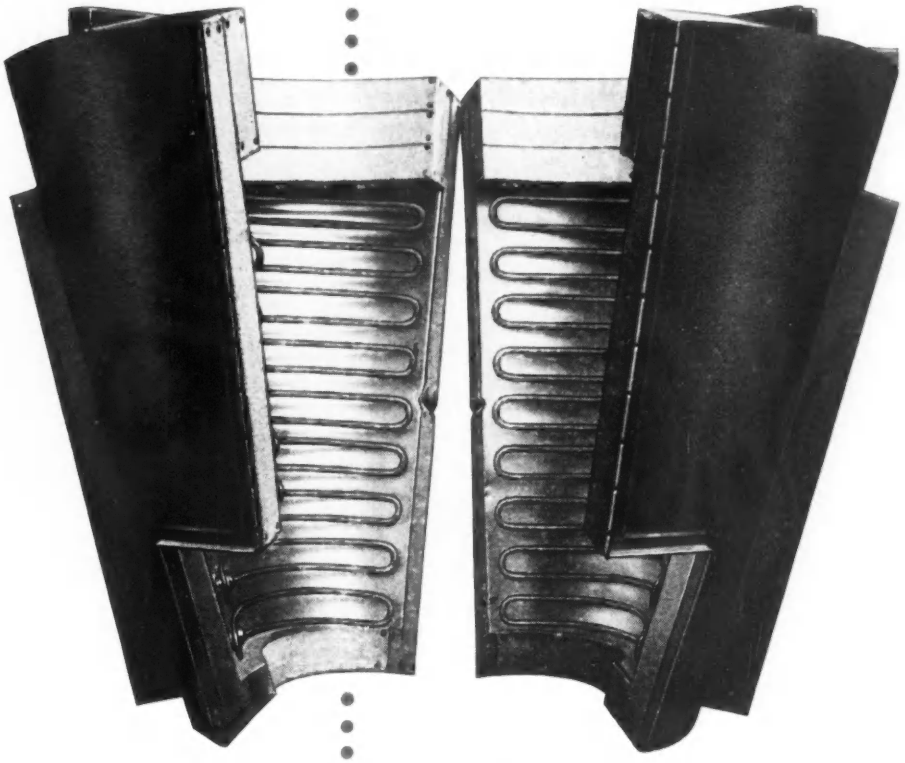
BTC chairman praises electrification achievements. Engineers and manufacturers lead in world. None of troubles "basic," pre-service testing not inadequate; but loco prices should come down. (809)

Three nuclear reactors authorised for British universities. London, Lancashire and Scotland areas, but precise siting undecided. (811)

Bevel-top motor brushes less efficient than flat-top in maintaining low contact resistance on commutators and slip-rings, shows study of forces acting on brush, confirmed in practice. (797)

BUSINESS—Plessey take over Regentone factory from Lloyd's Packing Warehouses (810) . . . Brook Motors earn more in first half, interim steady . . . Power Securities earn less but maintain dividend . . . Barton and Sons report record profit, higher dividend and 1-for-4 scrip issue . . . (813)

OVERSEAS—£3m. Colonial Development Corpn. loan for Tanganyika Electric Supply Co.'s Hale h.e. project . . . Cyprus seeking loan for power development . . . Ghana awards Volta dam contract to Impresit . . . World Bank grant $22m. loan to Colombia for h.e. development . . . Ontario provides $60m. for subway speed-up . . . Alaska hydro electric survey completed . . . New meter factory for India. (814, 815)



Photograph by courtesy of Messrs. Electroway Heaters Limited

electric heaters for Research purposes

The problem of obtaining the right amount of heat in exactly the right place can often be solved by using tubular sheathed heating elements.
"Backer" design and production are always at your disposal —even for small batch productions of prototypes for research purposes, and, with unlimited combinations of sheath materials and ratings within our scope, we are confident that we can find the answer to your problem.
Illustrated is a special tapered Chemical Reactor having a total rating of 16kW. Expressly "Tailored" to the needs of the Research Authority and built by Messrs. Electroway Heaters Limited.

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Europe's Leading Heating Element Specialists

THE BACKER ELECTRIC COMPANY LIMITED

ROTHERHAM. YORKS. *Telephone; Rotherham 78181 (8 lines) Telex; 54161.*

NEWS SHEET

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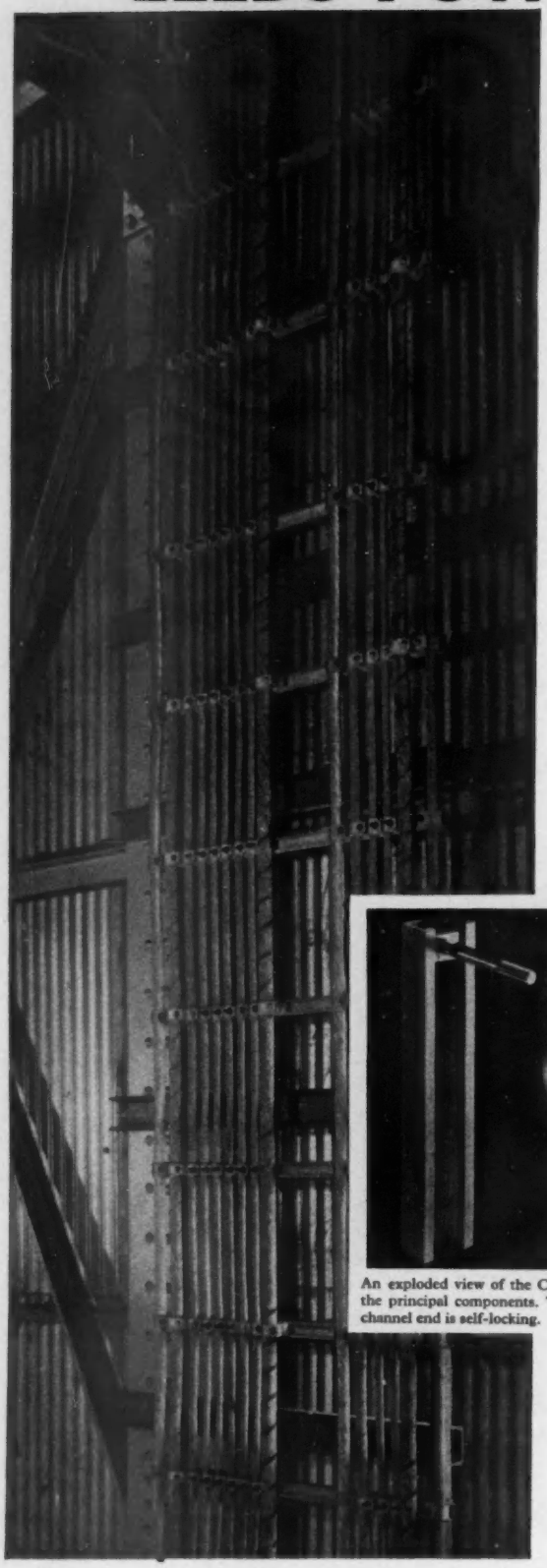
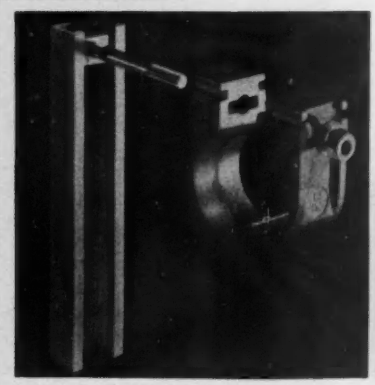
LEEDS POWER STATION USES CS (CABLOK) REGD. CABLE SUPPORTS

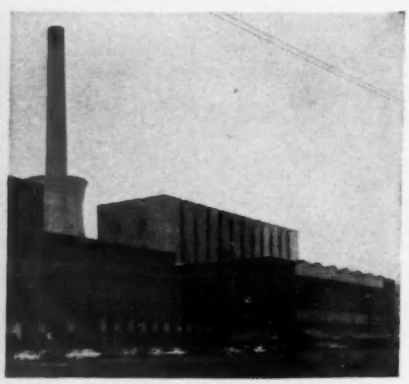


This immaculate cable run is part of the Central Electricity Generating Board's new installation at Skelton Grange 'B' Power Station, Leeds. It employs the new CS (Cablok) system of cable supports which is gaining rapid favour everywhere. This system was chosen not only for its excellent appearance but also for the following outstanding advantages:

* The unique hook section eliminates manual holding of cable during fixing.
* A universal channel section simplifies adaptation vertically and horizontally.
* All components are in aluminium alloy to B.S. 1490 and 1476 for maximum corrosion resistance.
* Careful design combines good appearance with economy.
* The cost is less, both initially and in installation.
* Sizes cater for cables ½" to 3" diameter.



An exploded view of the C.S. system showing the principal components. The backnut at the channel end is self-locking.



C.E.G.B.'s Skelton Grange 'B' Power Station, Leeds. Consulting Engineers: Merz and McLellan. Contracting Engineers for Cabling Installation N. G. Bailey & Co. Ltd.

CS (CABLOK) CABLE SUPPORTS OUTDATE OTHER SYSTEMS

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CABLE SUPPORTS LIMITED

301 BRIXTON ROAD · LONDON · S.W.9

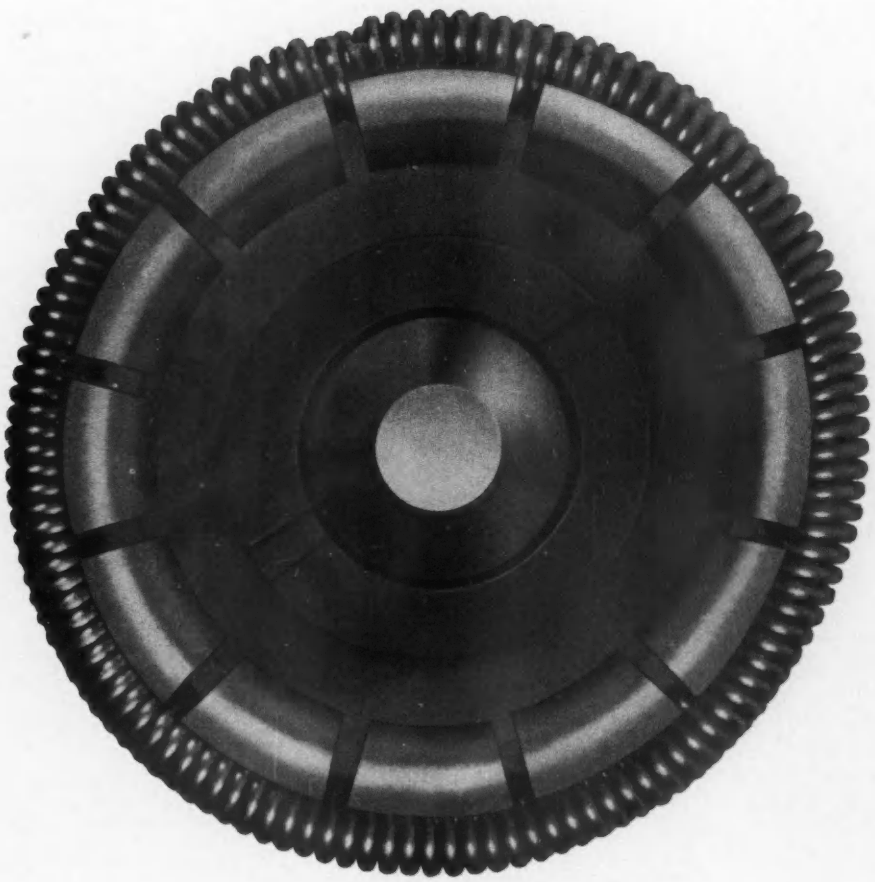
Telephone: Brixton 1103/5696

Take a new view of Ellison

Whichever way you look at it, this isolating socket for an Ellison 11kV 350 MVA circuit breaker represents a minor masterpiece of engineering. It mirrors that striving towards perfection so evident in every component that goes into the making of Ellison Switchgear.

Ellison Switchgear is manufactured to a standard rather than to a price, in the honest belief that this is the only way of manufacturing completely reliable switchgear. Ellisons have been long enough in the business to know what they're talking about.

Their formula? . . . Traditional skill, modern production methods and over half a century of specialised engineering knowledge. Add to this, bold and dynamic design that will still be ahead of its time in the next half century and you will understand why Ellison Switchgear is the finest in the World.



TRADE MARK

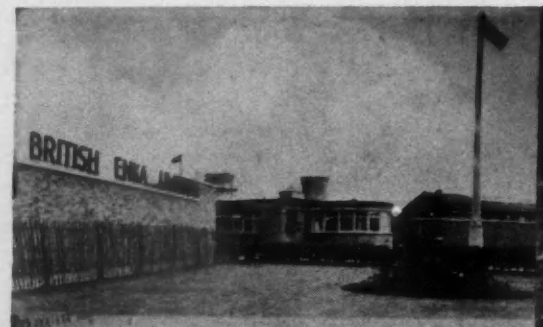
ELLISON SWITCHGEAR

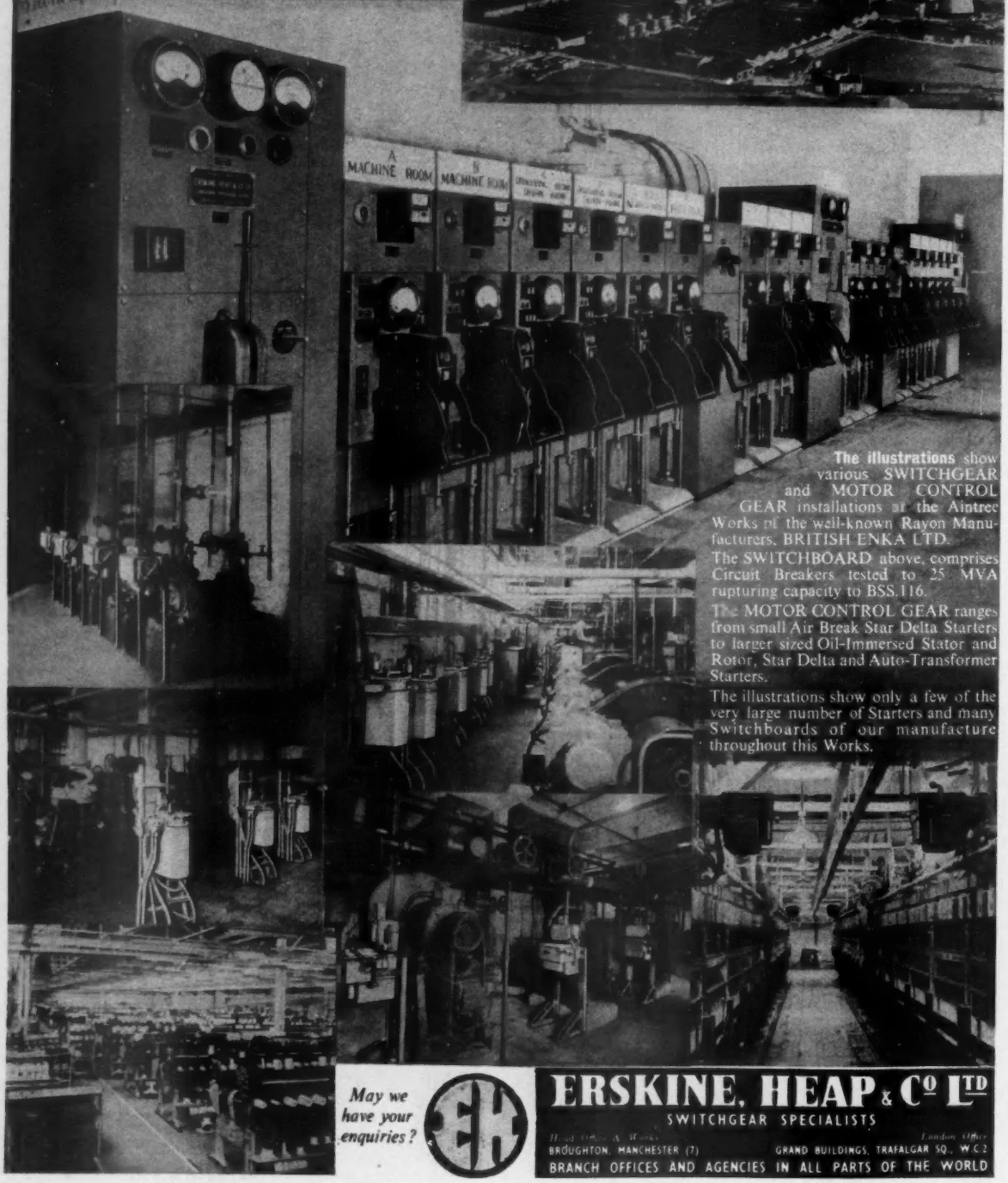
—for complete reliability

GEORGE ELLISON LIMITED · PERRY BARR · BIRMINGHAM 22B

883

"Erskine Heap" installation at BRITISH ENKA LTD.,





The illustrations show various SWITCHGEAR and MOTOR CONTROL GEAR installations at the Aintree Works of the well-known Rayon Manufacturers, BRITISH ENKA LTD.

The SWITCHBOARD above, comprises Circuit Breakers tested to 25 MVA rupturing capacity to BSS.116.

The MOTOR CONTROL GEAR ranges from small Air Break Star Delta Starters to larger sized Oil-Immersed Stator and Rotor, Star Delta and Auto-Transformer Starters.

The illustrations show only a few of the very large number of Starters and many Switchboards of our manufacture throughout this Works.

May we have your enquiries?

ERSKINE, HEAP & Co LTD

SWITCHGEAR SPECIALISTS

Head Office & Works: BROUGHTON, MANCHESTER (7)

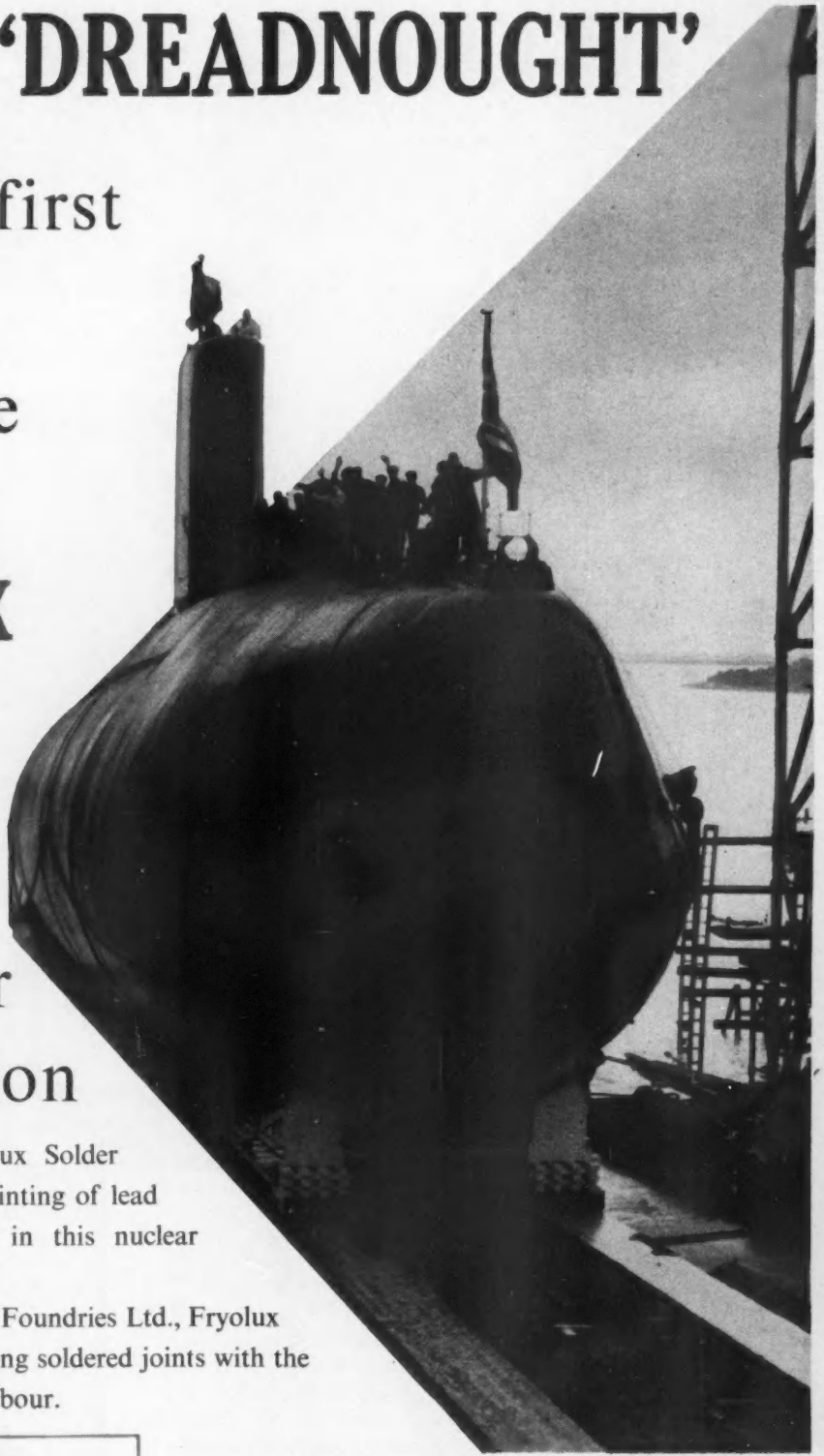
London Office: GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

BRANCH OFFICES AND AGENCIES IN ALL PARTS OF THE WORLD

695

H.M.S. 'DREADNOUGHT'

Britain's first nuclear submarine has **FRYOLUX SOLDER PAINT** used in her construction



A special form of Fryolux Solder Paint was selected for jointing of lead radiation shielding used in this nuclear powered submarine.

Made only by Fry's Metal Foundries Ltd., Fryolux Solder Paint produces strong soldered joints with the minimum of time and labour.

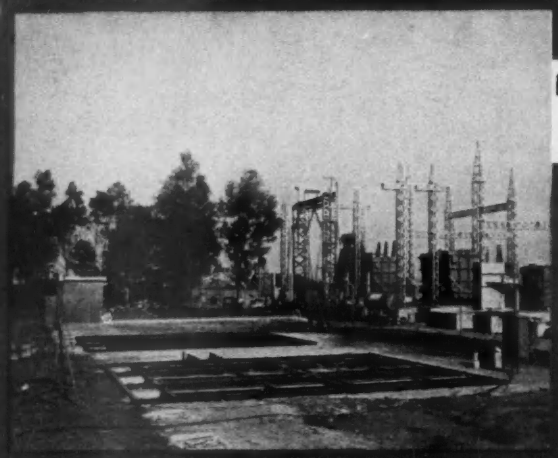
FRY'S Metal Foundries Limited

Tandem Works, Merton Abbey, London, S.W.19. Tel: MITcham 4023 (7 lines).

And at: MANCHESTER · KIDDERMINSTER · GLASGOW · DUBLIN

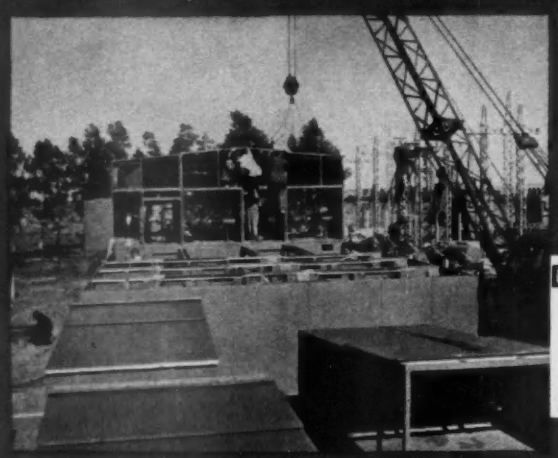
MRP 126.

... in a matter of DAYS



A 33kV duplicate busbar 'package' substation. Concrete plinth and base frame—after 2 days.

C 33kV duplicate busbar 'package' substation — complete after 21 days.



B 33kV duplicate busbar 'package' substation. Erection progress after 6 days.

The speed with which S.W.S. 33kV package switchgear can be installed is phenomenal in the field of extra high voltage switchgear.

Fast installation is due to accurate factory planning and the fact that the bulk of drawing office work, usually performed by the customer, is carried out at the S.W.S. factory before delivery to site. This not merely saves installation time but represents a decided saving in customers' drawing office costs.

PROVEN IN SERVICE

in Borneo; Hong Kong; South Africa; U.S.S.R; Venezuela; West Indies; And in Great Britain with the E.E.B; E.M.E.B; M.E.B; N.W.E.B; S.E.B; S. Wales E.B; S. West E.B; S. of Scot. E.B; C.E.G.B. (S. Wales Div.); & N.C.B.

SOUTH WALES SWITCHGEAR LIMITED

BLACKWOOD · MONMOUTHSHIRE · WORKS AT TREFOREST AND BLACKWOOD

SWITCHGEAR · FUSE-SWITCHGEAR · TRANSFORMERS · CONTROL BOARDS

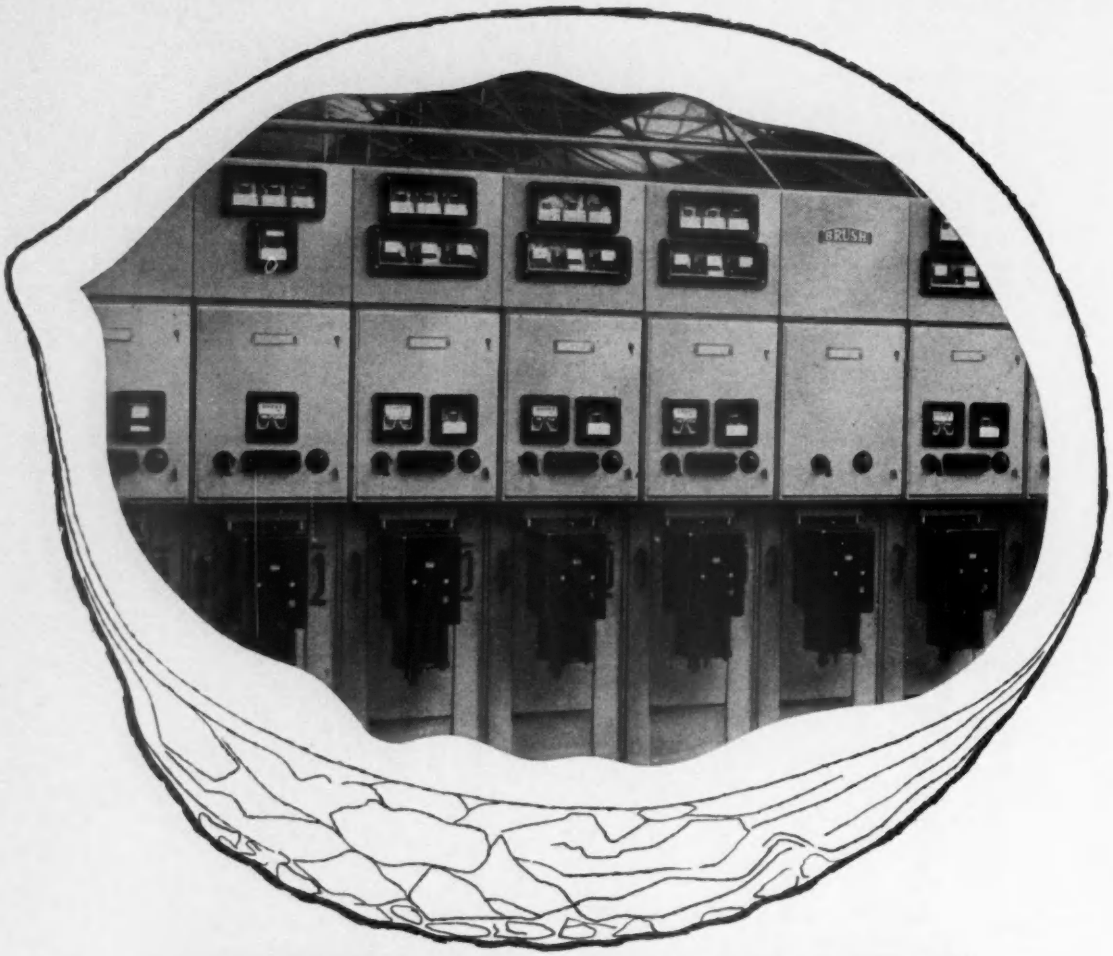
the FIRST ORDER for 400kV goes to DOULTON MULTICONE

AT HIGH MARNHAM
12 Upright Posts
Comprising
6 Switchgear Type
6 Busbar Support Type
3 For Inverted Mounting

AT MONK FRYSTON
5 Upright Posts
3 Inverted Posts for Busbar Supports

DOULTON INDUSTRIAL PORCELAINS LIMITED

ROYAL DOULTON POTTERIES · WILNECOTE · TAMWORTH · STAFFS · ENGLAND



HOW COMPACT CAN YOU GET ?

Switchboards with piecemeal extensions are a thing of the past.
This Metalclad Switchgear by Brush not only presents a uniform appearance — it saves space too. Standardised additions can be easily installed — every one as neat as the first.

Brush Switchgear offers: *Versatility. Compactness at high MVA Ratings. Easily accomplished uprating to higher MVA levels.*

Brush Metalclad Switchgear for Supply Industry and General Industry.

3.3. kV 75 MVA 150 MVA · 6.6. kV 150 MVA 250 MVA 350 MVA
11. kV 150 MVA 250 MVA 350 MVA 500 MVA

For all the above ratings the Brush range can be supplied in 400, 800 and 1,200 ampere units in 2' panel widths and 1,600 ampere units in 2' 6" panel widths. Can be supplied with air-insulated or compound-filled bus bar chambers for single or double bus bar arrangements. All ratings certified by the Association of Short Circuit Testing Authorities to BS 116/1952 and relevant ASTA rules.

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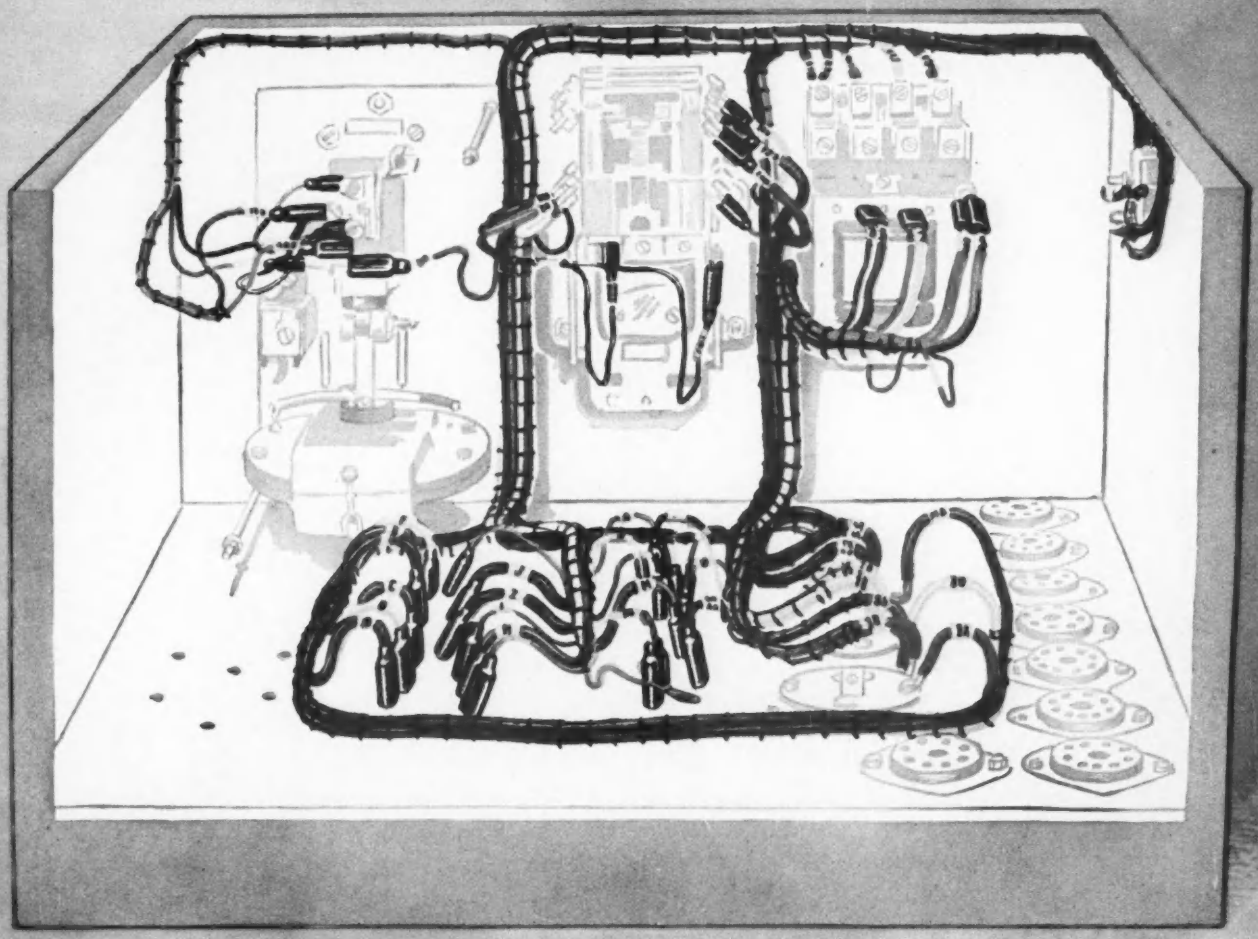
BRUSH ELECTRICAL ENGINEERING CO. LTD · LOUGHBOROUGH · ENGLAND

A member of the Hawker Siddeley Group.

RIST'S SIMPLIFY WIRING



BY SUPPLYING PRE-FORMED HARNESSES AS COMPLETE WIRING UNITS

- Moulded electrical assemblies
- Approved electrical cables for aircraft
- Cables for airborne and ground electronic equipment
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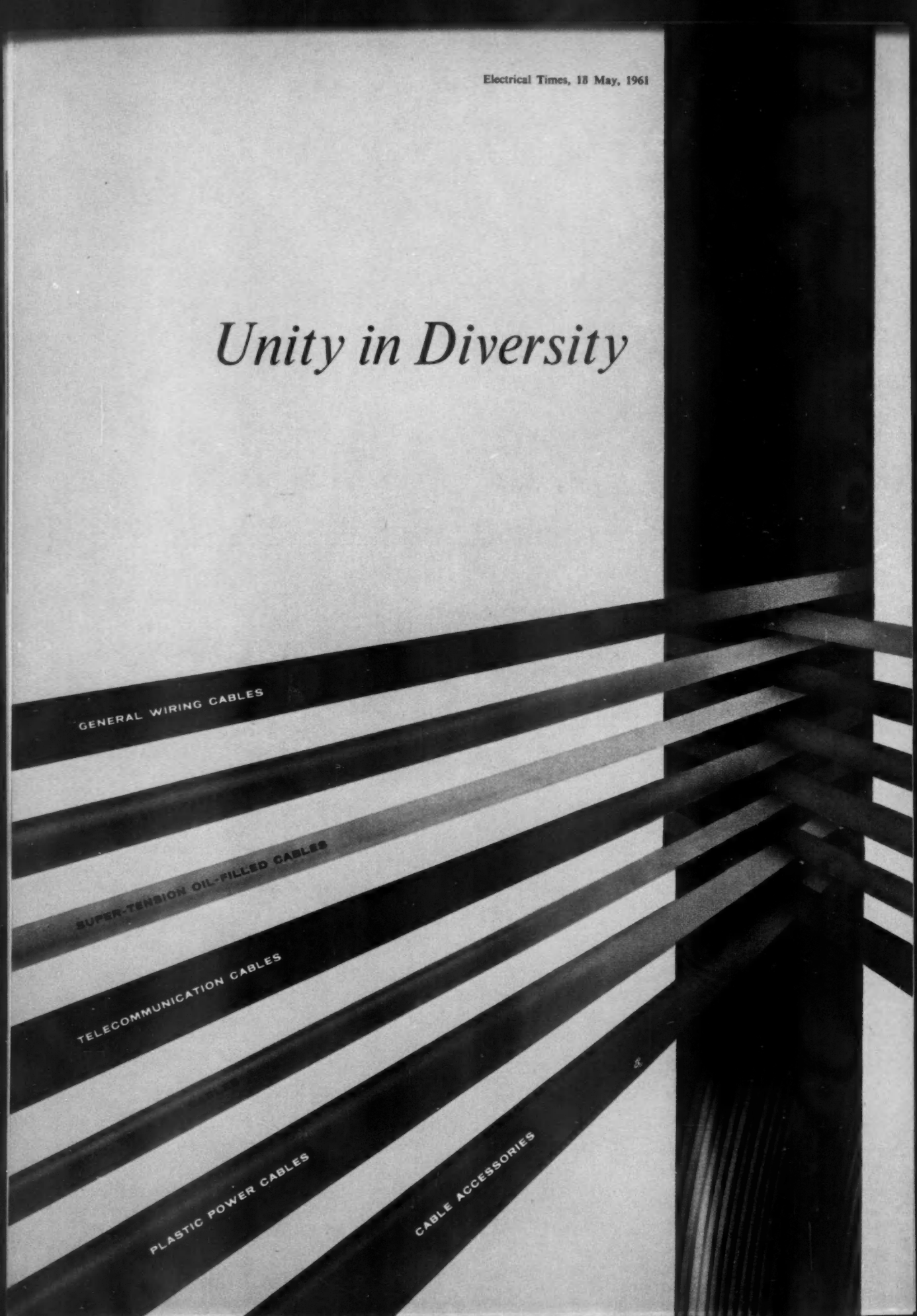
LOWER MILEHOUSE LANE · NEWCASTLE · STAFFS

Sole London Distributors for Housewiring Cables and Flexibles:—

LYMELITE ELECTRICAL INDUSTRIES LTD., 134 Pentonville Road, London, N.1 *Tel:* **TERminus 9631/2**

Unity in Diversity



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A compact, self-contained organisation, long established at Southampton and Eastleigh for the manufacture, development and sales of wires and cables for the electrical industry.

Pirelli-General offers the most comprehensive cable service to industry today. Continuing research and development maintains Pirelli-General's technological leadership, the results of which are available to all.

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V.I.R. and P.V.C. Insulated cables for general purposes — Impregnated Paper Cables and Accessories · Super-Tension Cables and Accessories · Telecommunication Cables for sound and picture transmission, audio and radio frequencies · Plastic Power Cables and Accessories · Shipwiring Cables, including butyl rubber insulation · Mining Cables, including trailing, shaft and roadway, signalling and telephone cables · Cables for Railway Electrification · Conductor wires, covered with enamel, textile and glass fibre, etc., insulants · Self-Supporting Aerial Pilot cables

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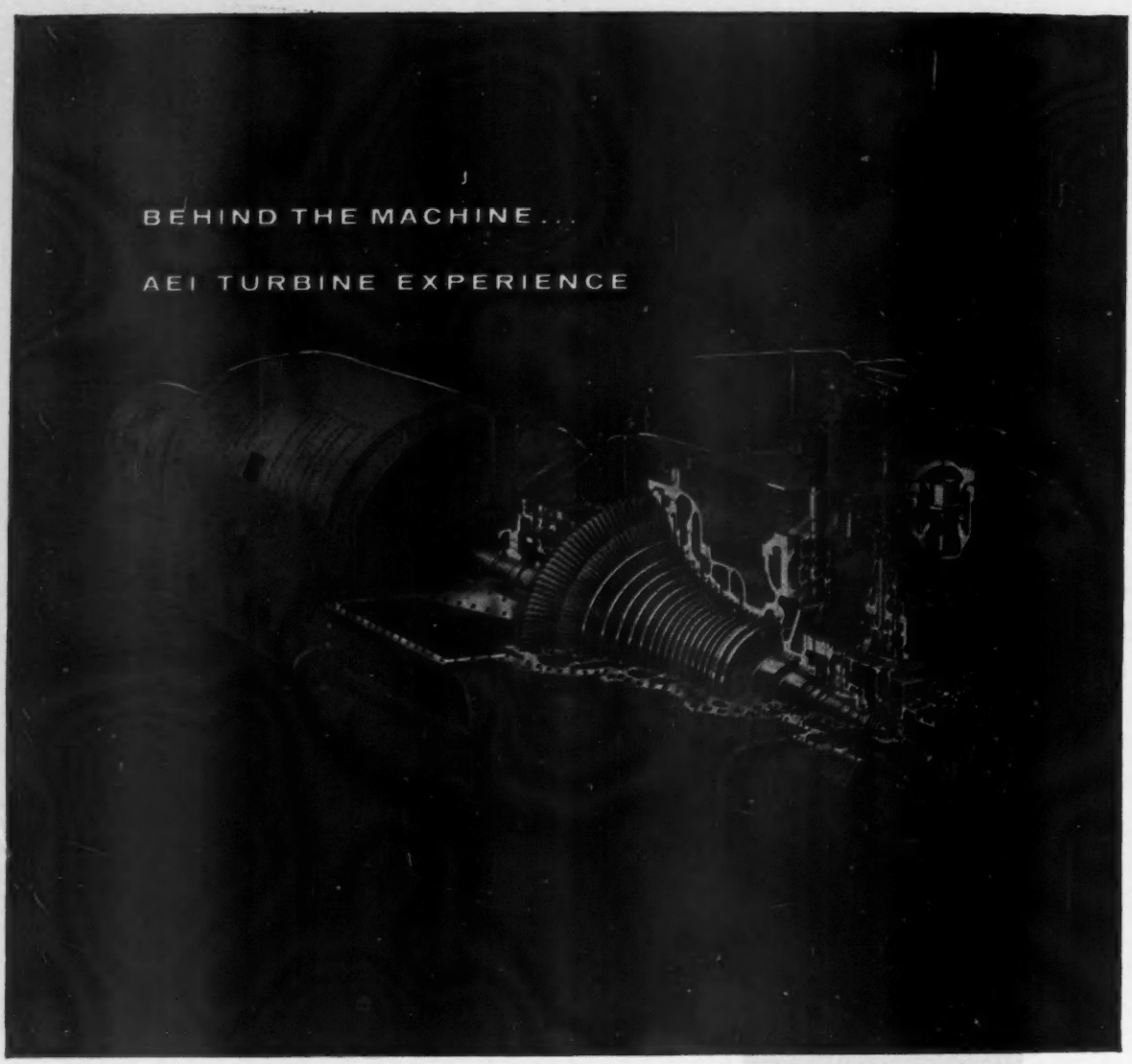

SINGLE CYLINDER TURBINES

Direct-coupled single cylinder units from AEI have long proved their worth in CEGB power stations. Now there is an increasing demand for machines of this type in the power development of newer countries and in industry. Units can be made for industrial use to supply pass-out steam for heating and process work.

The AEI range of small machines is described in the publication "Small Steam Turbines and Turbine Generator Sets." For further information, contact your nearest AEI office or write direct to AEI Turbine-Generator Division.

Single cylinder turbines are built by AEI with outputs from 5 to 35 MW. These direct-coupled turbines incorporate multi-stage feedwater heating, spring-backed labyrinth rings to prevent inter-stage leakage and spring-backed packing rings in high-pressure glands. The outstandingly reliable lubricating and governing systems are the result of over half a century of turbine experience. Quality of all materials used is assured by the most exacting testing techniques.

AEI

Associated Electrical Industries Ltd.
Turbine-Generator Division

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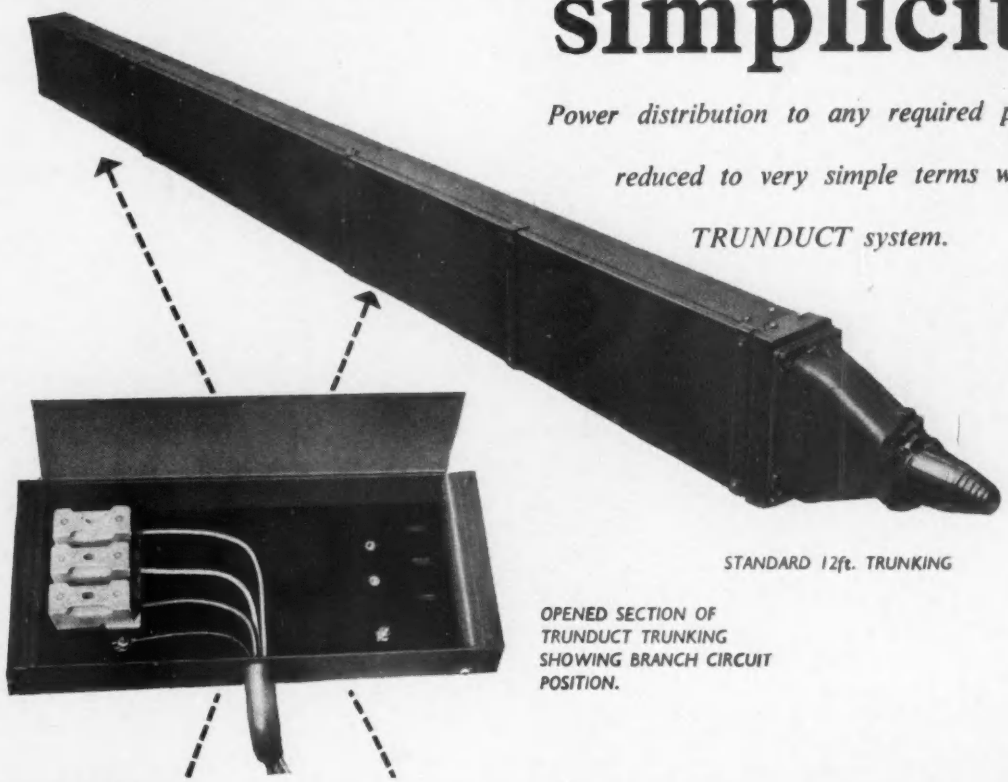
101 5/8

TRUNDUCT simplicity

Power distribution to any required point is reduced to very simple terms with the TRUNDUCT system.



STANDARD 12ft. TRUNKING

OPENED SECTION OF TRUNDUCT TRUNKING SHOWING BRANCH CIRCUIT POSITION.

TRUNDUCT ADVANTAGES IN LONG OR SHORT TERM PLANNING

Copper busbars used in a new economical manner are carried within standard lengths of steel ducting. Spaced along each length are four branch circuit positions which contain the necessary fuses plugged direct on to the main bus-bars. Tapping-off boxes are eliminated. This system provides much more efficient use of the bus-bars, cuts out potential sources of contact and earthing troubles normally associated with tapping-off boxes, provides easier methods of installation, saves time on planning, ordering and installation and offers the easiest possible way for balancing phases. In whatever way the system is installed it presents a clean streamline appearance.

You should investigate the **TRUNDUCT BUSBAR DISTRIBUTION SYSTEM**

Write now for a fully illustrated folder giving details of main power distribution 200-600 amps, small power distribution up to 125 amps and rising main distribution.

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LONDON OFFICE: 417 GRAND BUILDINGS, TRAFALGAR SQUARE, LONDON, W.C.2
GLASGOW OFFICE: 125 WEST REGENT STREET, GLASGOW

Telcon Bimetal for temperature indication

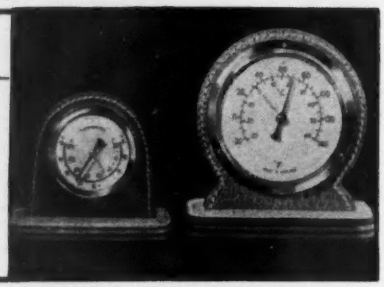
Telcon Bimetals are widely employed in many types of thermometers, typical examples of which are manufactured by Regwell Limited and illustrated below.

Thermostatic Bimetals consist of two layers of alloys bonded together at their interface and having different coefficients of linear expansion. When subjected to temperature change, the strips will deflect or spirals will rotate to give an indication of temperature.

Bimetal elements are ideal for use in the manufacture of thermometers, control elements for air conditioners, ventilators, water mixers, valves, driers, ovens, domestic irons, immersion heaters, radiators, thermostats, fire alarms etc.

Table giving the properties of the more important types of Telcon Thermostatic Bimetals.

Type	Strip + Deflection Constant	Electrical resistivity Microhm-cm at 20°C	Range of max. Sensitivity °C	Useful deflection Range °C	Stabilising Heat Treatment Temp. °C for one hour
140	14.0 x 10-6	75	20-200	-70-350	350
400	12.0 x 10-6	70	70-300	-70-400	350
15	9.5 x 10-6	16.7	20-120	-70-220	350
75	6.8 x 10-6	57	150-300	-70-500	350
38	3.8 x 10-6	56	20-250	-70-500	350
188	9.0 x 10-6	93	10-150	-70-500	350
131	13.3 x 10-6	18	10-120	-75-150	175
11	8.4 x 10-6	20	10-150	-70-350	350



The deflection constant (d) is defined as the deflection of a strip of unit length and unit thickness for each °C rise in temperature over the linear part of the deflection curve.

All types of Bimetal shown in the table are manufactured in strip form down to 0.005 in. thick, in widths not greater than 5 in. They can also be supplied down to 0.0025 in. thick with a maximum strip width of 2 in. Cut strips are also supplied. Materials can be suitably etched to indicate the high or low expansion sides, as requested.

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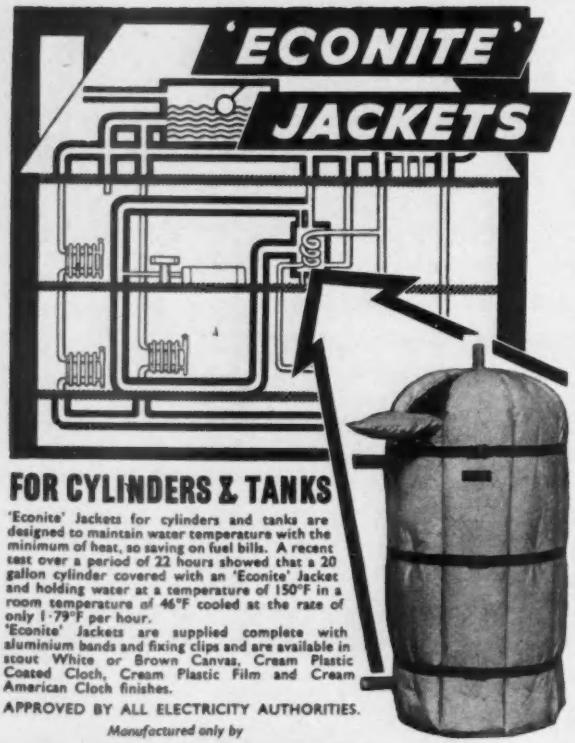

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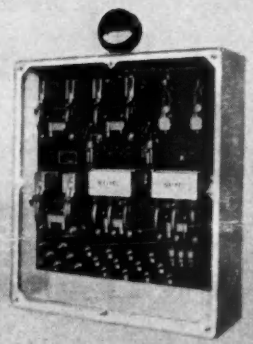

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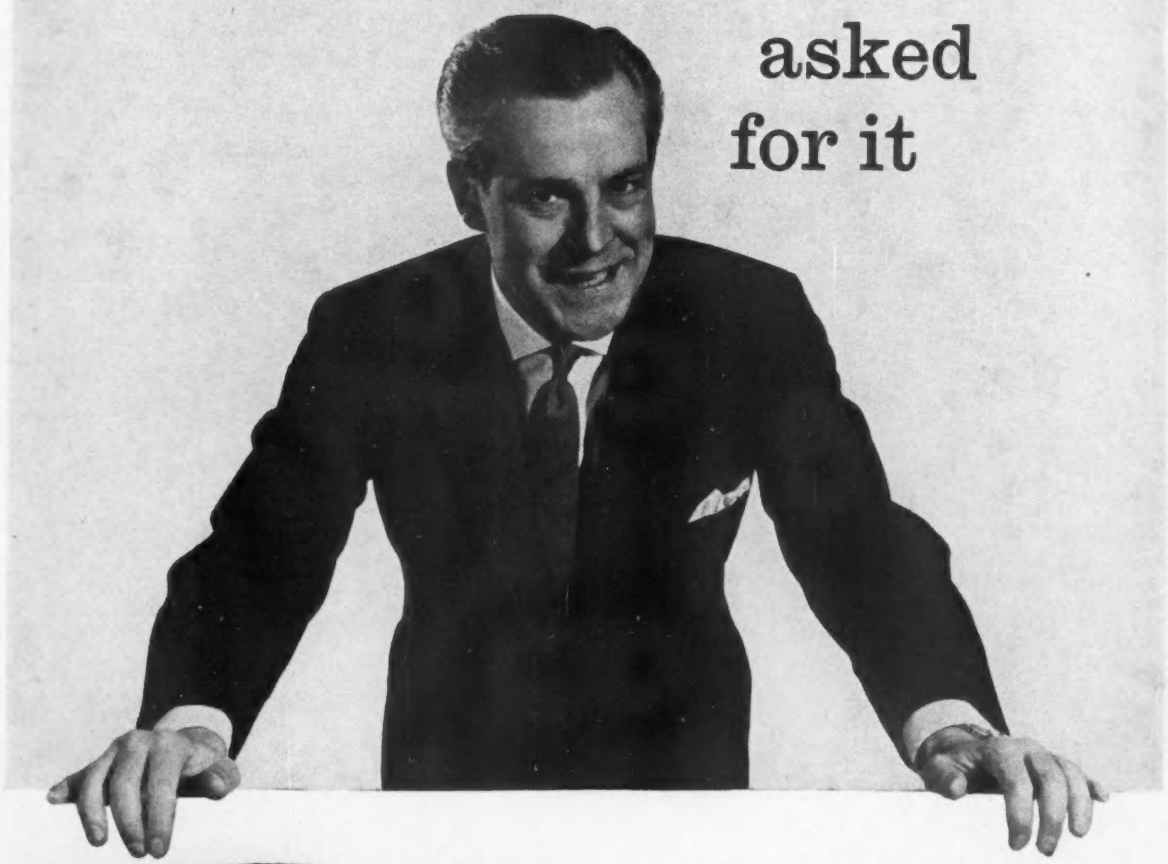

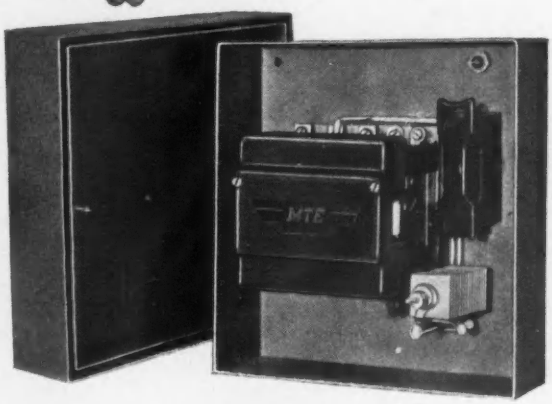

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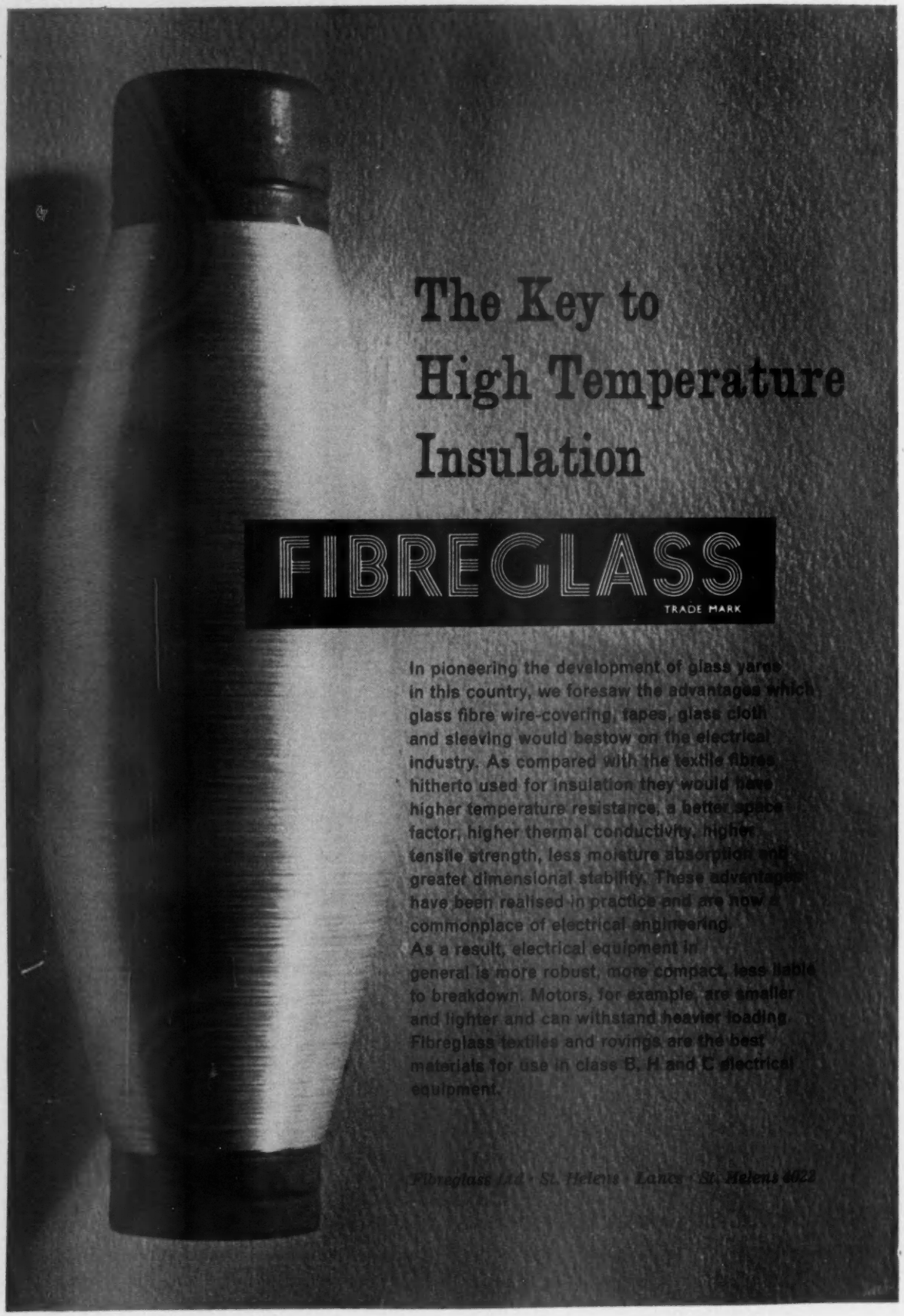
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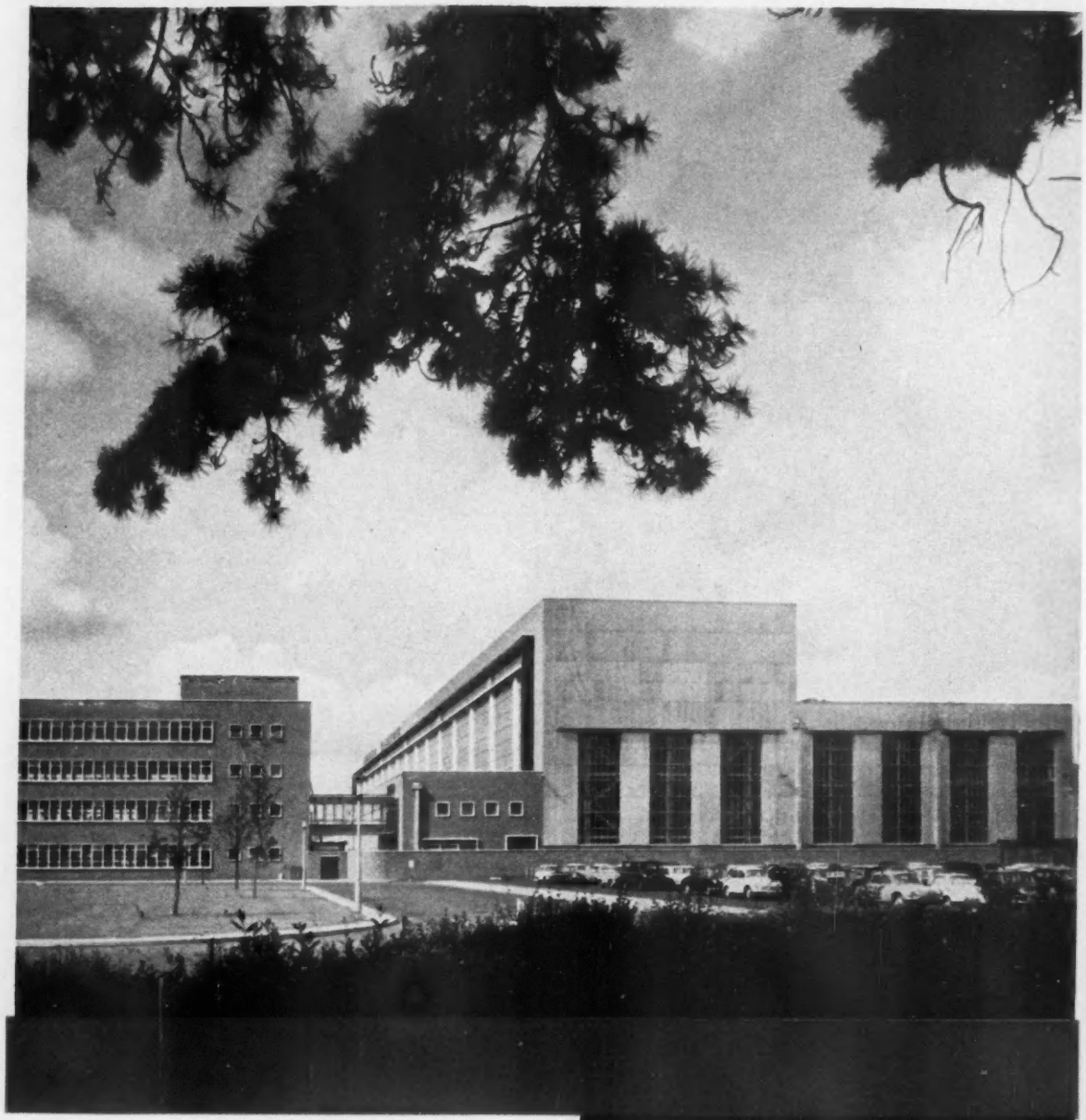

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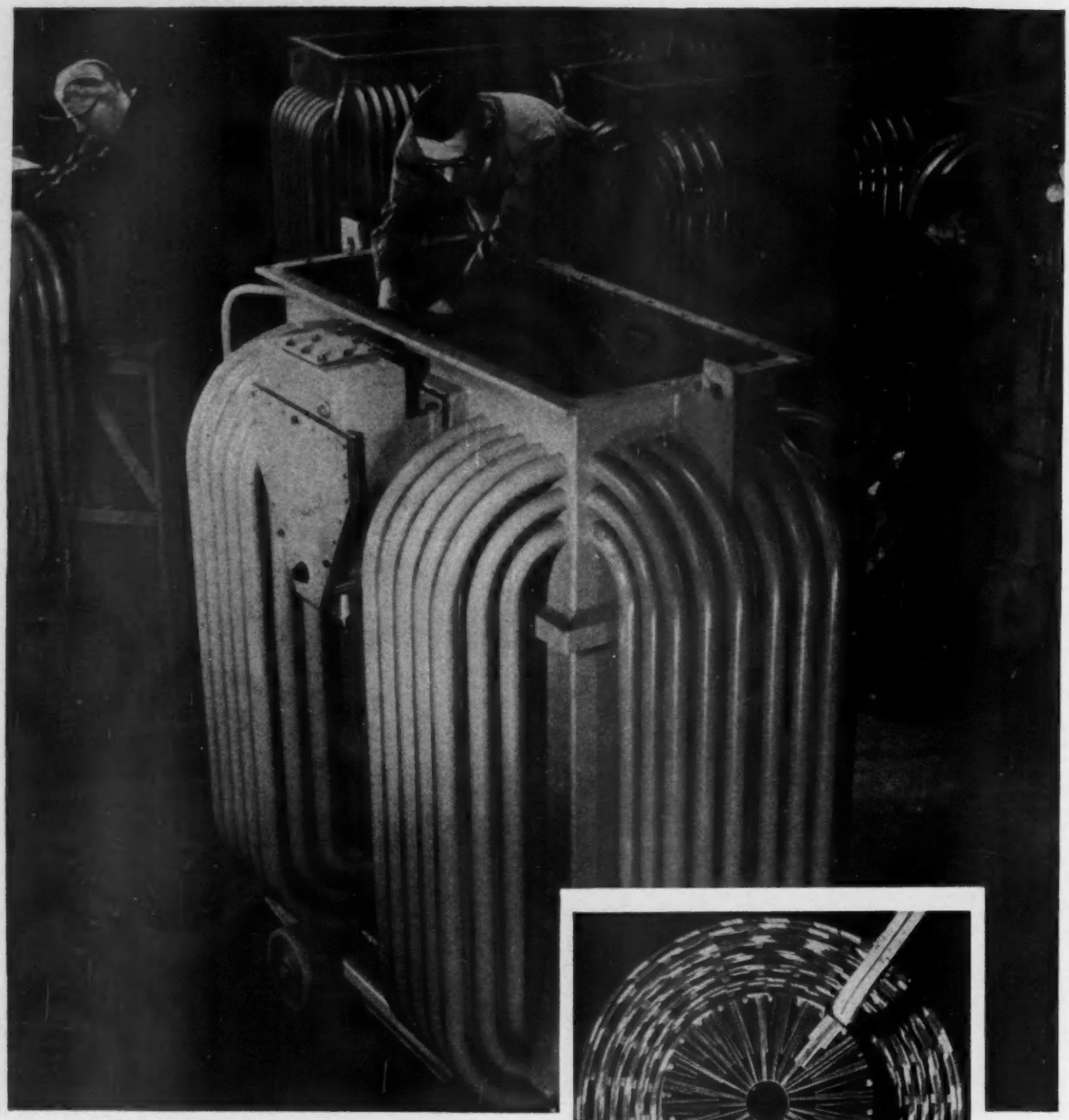
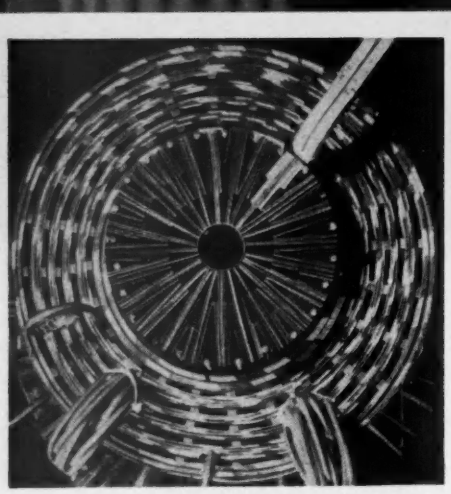


Inside the works a specialist works inside the works of a Lindley Thompson transformer. As you know, this highly respected firm produces extremely efficient power transformers, standard *and* special, in many different sizes.



A bird's-eye view of the winding of a Lindley Thompson radial type transformer.

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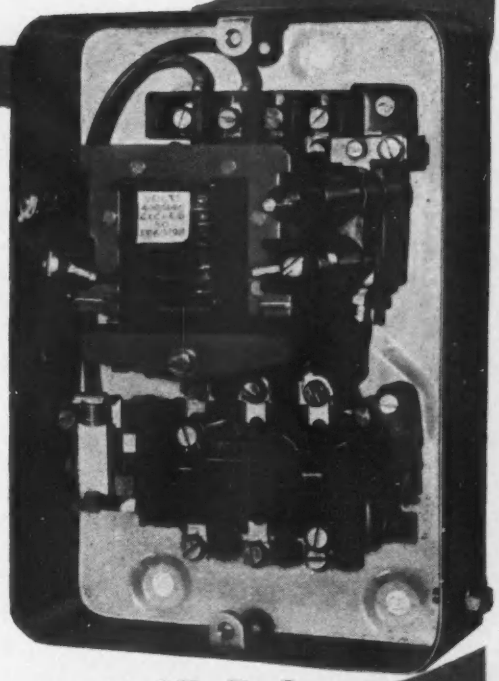

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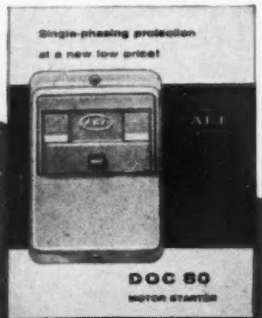

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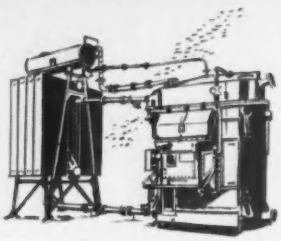

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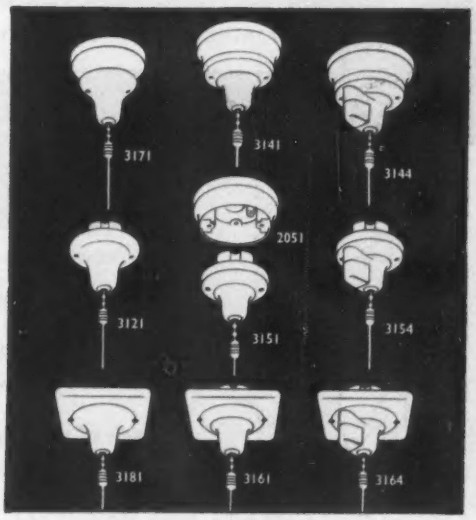

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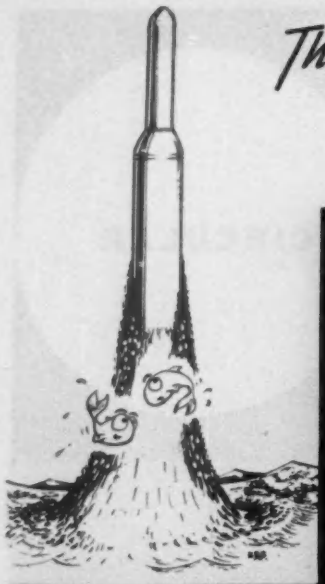

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THURSDAY 18 MAY, 1961
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

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Dans ce numéro

Circuits imprimés pour les applications de puissance 781

Les circuits imprimés sont d'un grand avantage si leur usage permet la réalisation d'un ensemble compact, la standardisation des pièces constituantes, et une durée d'assemblage réduite. Citons comme applications typiques les commutateurs auxiliaires de contrôle pour le branchement en charge sur transformateurs. et un adapteur à fiche et douille à l'usage ménager. Des résistances imprimées peuvent aussi être incluses avec le circuit imprimé afin de donner un montage compact, et l'usage d'un dissipateur de chaleur intégral en aluminium permet d'obtenir une valeur nominale élevée. L'on a mis au point des moteurs avec des armatures à circuits imprimés. ayant des valeurs nominales de jusqu'à 1 ch.

Balais en carbone pour moteurs 797

Une analyse des forces agissant sur le balais en carbone dans le porte-balais d'un moteur électrique indique la présence de trois de ces forces: la force appliquée par le ressort ou le bras du ressort, la réaction du commutateur, et une réaction latérale venant de la boîte à balais. Lorsqu'elle est appliquée à des balais à bout biseauté, la force du ressort varie avec l'usure. Les essais affectués confirment la théorie admise pour les balais à bout plat, mais ils indiquent aussi que les balais à bout biseauté se comportent beaucoup mieux qu'on ne le pensait.

Electricité en Inde 801

La consommation d'électricité en Inde par personne n'est que de 0,04 MWh par an, comparée à 2 MWh en Grande-Bretagne et 4 MWh aux Etats-Unis. La production et le consommation ont plus que doublé au cours des dix dernières années. La capacité totale des installations était de 2.300 MW en 1951; elle atteignit 3.400 MW au cours du premier plan quinquennal, et 5,800 MW au cours du deuxième plan quinquennal. L'on prévoit un chiffre supplémentaire de 6,000 MW au cours du plan quinquennal actuel, dont 300 MW seraient fournis par des centrales nucléaires.

In dieser Nummer

Gedruckte Schaltungen in der Starkstromtechnik ... 781

Gedruckte Schaltungen sind überall da von Wert, wo ihre Verwendung eine gedrängte Bauart, die Normierung von Bauelementen und eine Zeitersparnis beim Zusammenbau ermöglicht. Beispiele hierfür sind Hilfssteuerschalter für strombelastete Stufenschalter von Transformatorenabgriffen und ein Zwischenstecker für den Hausgebrauch. Die gedruckte Schaltung mag gedruckte Widerstandselemente umfassen, womit die Einheit noch gedrängter wird, sowie einstückig verbundene Wärmeableitelement aus Aluminium, die zur Erzielung einer hohen Nennleistung verhelfen. Motore mit gedruckten Ankern wurden für Nennleistungen bis zu 1 PS gebaut.

Kohlebürsten für Motore 797

Eine Analyse der Kräfte, die auf die in ihrem Halter befindliche Kohlebürste eines Elektromotors einwirken, zeigt, dass diese dreifacher Art sind: Die von der Feder oder vom Federarm ausgeübte Kraft, die vom Kollektor herrührende Gegenkraft, und eine seitlich wirkende, von der Bürstenhalterung herrührende Gegenkraft. Wenn die Federkraft auf Bürsten mit abgeschrägtem Ende einwirkt, so ist sie je nach Verschleiss verschieden. Versuche haben die geltenden theoretischen Werte für Bürsten mit flachem Ende bestätigt, deuten jedoch darauf hin, dass die für Bürsten mit schrägem Ende angenommenen Werte unterschätzt werden.

Die Elektrifizierung Indiens 801

Der Stromverbrauch pro Kopf der Bevölkerung beträgt in Indien nur 0,04 MWh pro Jahr gegenüber 2 MWh in England und 4 MWh in den U.S.A. Während der letzten zehn Jahre stiegen Krafterzeugung und -verbrauch um mehr als das Doppelte an. Im Jahre 1951 betrug die Kapazität der vorhandenen Installationen 2300 MW; diese Ziffer wuchs während des ersten Fünfjahresplans auf 3400 MW und während des zweiten Fünfjahresplans auf 5800 MW an. Während des laufenden Fünfjahresplans erwartet man eine weitere Steigerung von 6000 MW, wovon 300 MW auf die Kernkraftergeugung entfallen.

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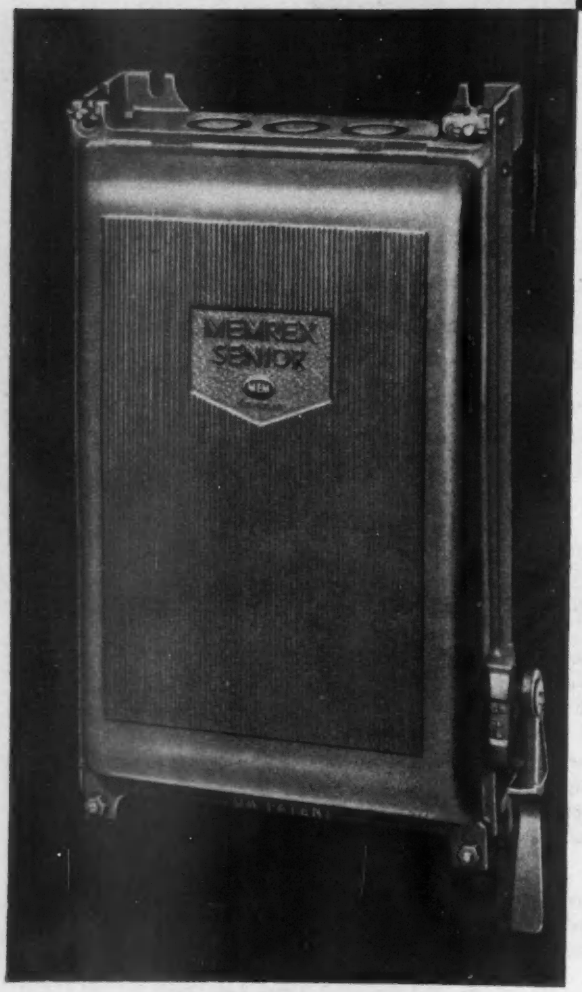

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Semi-enclosed rewirable fuses comply with B.S.3036.

H.R.C. cartridge fuse carriers will accommodate H.R.C. cartridge fuse-links to B.S.88: 1952, Appendix 'J' Dimensions. Form A—Offset Tags.

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 18 MAY, 1961

Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Joint Editor:
K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor:
T. W. WRIGHT

Comment

WHY OFF-PEAK HEATING WORKS

Claims made for low energy consumption by off-peak electrical storage heating systems have often been greeted with scepticism by heating engineers used to conventional methods. Their extensive experience with other fuels had convinced them that it was just not possible to make buildings comfortable with the heat inputs quoted. In fact, heating engineers have found no difficulty in finding fault with the calculations of the electrical industry. But one consideration has taken the sting out of their criticisms. Off-peak heating has worked. Occupants of buildings using it have been comfortable. Those who have had to foot the electricity bills have been pleased. How is the mystery, the apparent contradiction, to be resolved? In one of its first reports, the Heating and Ventilating Research Association has tackled this important question, and the results it produces are of the highest value to the electrical industry. There seem to have been four main causes of discrepancy, factors of which heating engineers have remained incorrectly informed, until the use of electrical methods forced the pace in research. Buildings collect more heat than had been realised from the metabolism of occupants, energy dissipation of lighting, solar radiation and other sources. Buildings lose less heat by conduction through walls and convection in ventilation than had been realised. And coal- or oil-fired boilers—an old story this—prove on measurement to have a thermal efficiency appreciably lower than test figures suggested. The low efficiency of the boilers tended to cancel out the underestimated heat gains and the exaggerated heat losses in conventional heating systems. Accurately metered electrical supplies have shown up the discrepancies. The HVRA report shows the way to more accurate designing of electric floor and block storage warming systems. Less adjustment with empirical factors will be necessary. But the economy of electrical floor-warming remains what it has already been proved. Electrical salesmen can now quote theory as well as experimental fact to explain why their system is so markedly cheaper than conventional alternatives.

VENTURE IN U.S.S.R.

The largest trade fair ever to be held in the USSR by a foreign country opens on Friday. This is Britain's biggest bid for a stake in Russia's expanding demands for Western goods; one which must add to our prestige and standing within the country, and in consequence the whole eastern bloc. The 620 exhibitors' displays are about equally divided between consumer goods and engineering and scientific equipment, with the Government exhibit stressing British achievements in science

and technology. In all, there are 48 electrical firms exhibiting, not an over-large number bearing in mind how active some firms have been in tackling Russian trade, with Mr J. B. Scott as chairman of the Russian section of the London Chamber of Commerce. Many of those exhibiting have already traded with USSR and know some of the special circumstances which surround such business. They will therefore not have been surprised that any requirements for services in connection with the Fair could not be placed directly with the USSR organisations concerned, but had to be canalised through the proper channels of the Fair organisers and then via the Russian Chamber of Commerce. They will know, also, that the recent improved ECGD terms will not be required, for USSR credit is good. During the coming fortnight, fingers will be kept crossed at the hope of improved trade, which is so dependent on USSR Government policy and on whether the Fair will have any impact on the satelite Communist countries.

IMPORTANCE OF TRAINING

Soon after the Whitsun holiday is over, Commonwealth Technical Training Week is to begin. Many readers will already have been caught up in the planning of this event, which is being organised by the City and Guilds of London Institute at the request of its president, the Duke of Edinburgh. The object is to rivet the public's attention on vocational training in all its aspects—the "technical" of the title is something of a misnomer. Exhibitions, open days and conventions are the staple diet of the programmes for the Week at local level, programmes that cover most countries of the Commonwealth as well as the British Isles. More important will be the lasting effects the Week should secure, in broader recognition of the importance of training for work in today's complex society. The electrical industry has for long been in the forefront of the movement to extend training. It stands to gain from wider recognition that it is worth the while of firms of all sizes to support schemes for training their workers. Such considerations add to the intrinsic worth of the occasion as a reason for lending support to the Week, and for being ready to follow up the opportunities it opens. From the Royal opening at London's Guildhall on Monday, 29 May, until its Sunday closing, the Week promises to be a crowded experience in concentrating public awareness.

INSULATED TO PROGRESS

Although developments in plastics technology have greatly extended the use of all-insulated construction in electrical engineering, metal casing remains the better strength giver in many instances. Particularly is this so where the hard knocks of industrial use are to be faced, or where decorative considerations must predominate. In such instances, double-insulation is increasing in popularity, offering safety from shock risk without dependence on earthing. But when double-insulation is suggested for portable electric tools in industrial applications, it runs hard against the provisions of the electricity regulations made under the Factories Acts. The difficulty is discussed in detail in this week's *Industrial Electricity* section. Under the 1908-enacted Regulations, exposed metalwork of portable tools must be earthed. Yet, surely, double-insulation is as good an answer to the shock danger experienced with portable tools, and commented on so frequently in Ministry of Labour reports? Double-insulation can be used in such circumstances only if the exposed metalwork of the tool is earthed as well; but earthing in this case can introduce danger as well as safeguard against it. Moreover, it is frequently the earthing arrangements on tools that fail and lead to accidents; they are especially vulnerable to any neglect in maintenance. The Regulations have survived usefully through many changes in electrical design and practice unforeseeable when they were drawn up. In this respect, however, they seem a barrier to progress. What is needed now is some easily applied procedure for varying them. It has become almost sacrilegious to suggest that any situations exist that cannot be brought within the rather flexible 1908 Regulations, but the time has come for the crime to be committed.

FIXED-PRICE COAL

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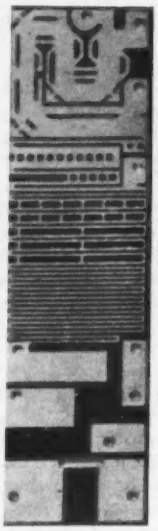

Printed circuits for power applications

SCOPE FOR FUTURE DOMESTIC AND INDUSTRIAL USE

Multi-range instrument shunt with trimming ladder

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Basic Processes

The varying manufacturing techniques for producing printed circuits are outside the scope of this article and they have, in any case, been extensively described in books and papers although, for obvious reasons, manufacturers are reluctant to disclose their specialised "know-how" for special applications. Briefly, the production processing adheres to the following pattern. Printed circuits or components are generally formed by etching away a thin copper coating, bonded to an insulating sheet, which may be synthetic resin bonded paper, epoxy resin bonded glass-fibre or other materials. The base insulating material may be up to ½ in. thick, with the thin copper laminae generally in three thicknesses, 0·0015 in., 0·003 in. or 0·0045 in. The layout of printed circuitry has a similarity with the design of logic control systems, for both require use of new concepts by the designer. The designer of printed circuits must think in terms of two dimensional circuits, with the width of the conductor, rather than its diameter, varying to meet different current requirements. He has also to keep in mind, where it is appropriate, the 0·1 in. module for mounting components; he must allow for adequate voltage clearance between conductors, restrict the power dissipation over the surface of the lamina to prevent overheating or warping and, if necessary, design the equipment in which it is to be used, with an eye to making the most economical use of the bonded sheets available from the manufacturers.

Bonded sheets are available up to 4 ft by 3 ft and these sheets are cut into rectangles to suit the particular printing techniques used, consistent with the size of the component being produced. When the circuit has been designed it is drawn accurately at least twice full size and possibly four or five times where precision is important. It is also vital to make the drawing on a material which is dimensionally stable. The drawing is then reduced to the exact components size photographically, on to a dimensionally stable negative which is either a glass plate or a suitable plastics film. For small, mass-produced components the drawing is printed many times on the negative plate by a special camera which can be indexed with great accuracy in perpendicular directions. Since these components will subsequently be punched from the laminate, their spacing must be precise to prevent cumulative errors over the sheet. The circuit pattern is transferred to the laminate by a screen, offset litho or photo-printing process, using an acid-resistant ink. The copper is then etched away on the non-inked portions of the lamina to leave the circuit pattern. This process is used where a copper circuit alone is adequate. If a plated finish is required, for example, switch contacts have enhanced life if they are rhodium plated, a reverse process is used. In this process, instead of acid-resisting ink being applied to the laminate in conformity with the circuit pattern, a blanking ink is

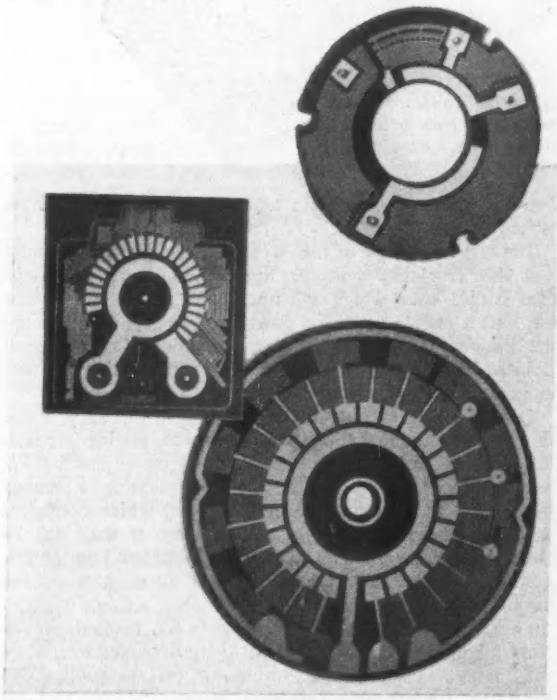

Fig. 1. A selection of switch plates with plated contacts and integral resistor elements formed by printed circuit techniques. The resistor element is formed from a cupro-nickel foil which may be bonded to an aluminium heat sink

and technology. In all, there are 48 electrical firms exhibiting, not an over-large number bearing in mind how active some firms have been in tackling Russian trade, with Mr J. B. Scott as chairman of the Russian section of the London Chamber of Commerce. Many of those exhibiting have already traded with USSR and know some of the special circumstances which surround such business. They will therefore not have been surprised that any requirements for services in connection with the Fair could not be placed directly with the USSR organisations concerned, but had to be canalised through the proper channels of the Fair organisers and then via the Russian Chamber of Commerce. They will know, also, that the recent improved ECGD terms will not be required, for USSR credit is good. During the coming fortnight, fingers will be kept crossed at the hope of improved trade, which is so dependent on USSR Government policy and on whether the Fair will have any impact on the satelite Communist countries.

IMPORTANCE OF TRAINING

Soon after the Whitsun holiday is over, Commonwealth Technical Training Week is to begin. Many readers will already have been caught up in the planning of this event, which is being organised by the City and Guilds of London Institute at the request of its president, the Duke of Edinburgh. The object is to rivet the public's attention on vocational training in all its aspects—the "technical" of the title is something of a misnomer. Exhibitions, open days and conventions are the staple diet of the programmes for the Week at local level, programmes that cover most countries of the Commonwealth as well as the British Isles. More important will be the lasting effects the Week should secure, in broader recognition of the importance of training for work in today's complex society. The electrical industry has for long been in the forefront of the movement to extend training. It stands to gain from wider recognition that it is worth the while of firms of all sizes to support schemes for training their workers. Such considerations add to the intrinsic worth of the occasion as a reason for lending support to the Week, and for being ready to follow up the opportunities it opens. From the Royal opening at London's Guildhall on Monday, 29 May, until its Sunday closing, the Week promises to be a crowded experience in concentrating public awareness.

INSULATED TO PROGRESS

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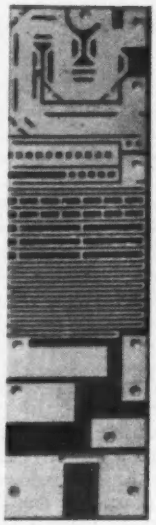

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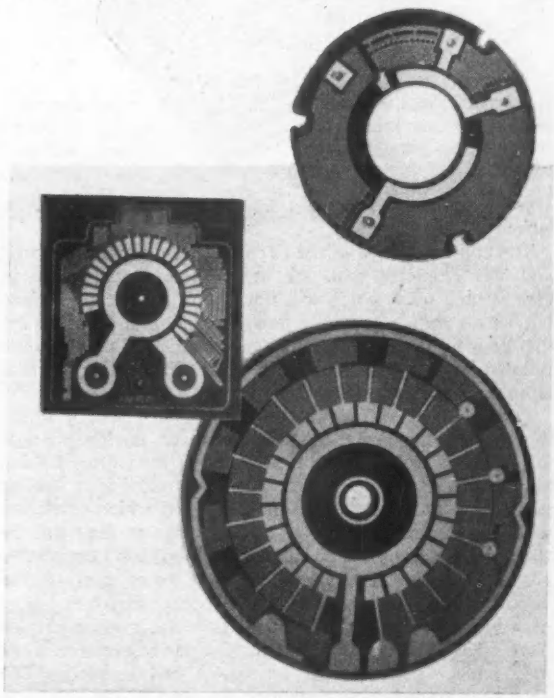


Fig. 1. A selection of switch plates with plated contacts and integral resistor elements formed by printed circuit techniques. The resistor element is formed from a cupro-nickel foil which may be bonded to an aluminium heat sink

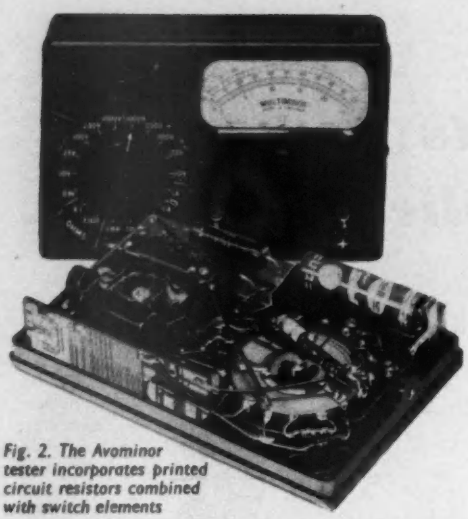


Fig. 2. The Avominor tester incorporates printed circuit resistors combined with switch elements

applied to the copper areas which have eventually to be etched away.

The copper surface of the circuit pattern remains exposed and this is plated with the appropriate metal. An acid etch is then used which will not attack the plated surface but which etches away the unwanted copper. In this way, the copper lamina provides an electrical link between isolated parts of the circuit pattern during plating, so that temporary plating connections are not necessary.

One of the great advantages of printed circuitry is the thinness of the insulating base. However, during processing, removal of large amounts of one of the copper lamina may cause the material to warp. By etching a similar pattern on the reverse side of the board which conforms with the circuit pattern but which may or may not be connected through the board, warping can be almost eliminated. The reverse pattern may form part of the circuit, as in the printed circuit motor armature, or it may be used as an earth screen. Broadly, printed circuits have three important interests for the power engineer. They may replace conventional wiring for certain applications even over considerable distances, they can be used to form complicated or simple switching plates with or without integral resistors, and they may be used to form resistors with substantial power dissipation. In general, it is unlikely that capacitive or inductive components will be produced in ratings sufficiently large to be regarded as heavy current equipment, although printed circuit fuses are being used for certain specialised applications. Use of printed circuits is already widespread for certain domestic equipment, for example, electric shavers, and, of course, radio and television sets.

Domestic Equipment

One domestic application of printed circuits with great possibilities is for the internal wiring of domestic plugs and sockets. An example is the Grelco adaptor, which has two 13 A, 3-pin sockets and one 5 A fused 3-pin socket. The adaptor contains a copper laminate which is etched away sufficiently to provide adequate electrical clearance between the earthed, line and neutral circuit patterns. At its minimum width the conductor is $\frac{3}{16}$ in. and will carry 18 A with a temperature rise of only 20°C.

Use of printed circuits in this adaptor enables a slim, light component to be manufactured with the advantage that all plug leads run straight down from the adaptor, with consequently less tendency to pull the adaptor from its socket or for the leads to cause danger by people tripping over them. Standardisation of parts, for example, clips and fuse holders, is possible and the basic triangular pattern lends itself to other combinations of pin- and socket-outlets.

In the manufacture of electric shavers, many makers are now incorporating printed circuit techniques. They enable a compact voltage selector switch to be constructed, while the similar technique of chemical milling is being used by at least one maker for the shaving head itself.

Switching and Resistors

An application of printed circuitry in heavy electric engineering is incorporated in the Fuller on-load tap-changer. The tap-changer is of the resistor type and is suitable for transformers rated up to 10 MVA 33 kV. It is driven by a $\frac{1}{4}$ h.p. induction motor through reduction gearing and tap-changing is initiated by direct-wire impulse-switching. The motor rotation is controlled through limit switches which are formed on a printed circuit board. A multi-position printed circuit switch, with interconnected resistors provides indication of tap-changer position. The motor switch has concentric segments of palladium-plated copper standing proud of the s.r.b.p. backing insulant. A plating thickness of 0·0005 in. is used, and tests have been made for 30,000 interruptions, representing over 500,000 tap-change operations of the 17-position switch. The switch contacts include isolated dwell segments, which were introduced to overcome arcing produced by the interruption of the highly inductive motor no-load current. Auxiliary switches using printed circuits with ratings of 0·25 A at 110 V have also been developed for the sequential operation of two or more tap-changers in parallel.

By using these printed circuit switch plates with riveted connections instead of the conventional drilled boards with studs, lock washers and locknuts, an estimated saving of between 27% and 36% of the cost of the component has been possible, largely through reduced assembly time.

Several manufacturers have applied printed circuit techniques to light current switching operations in which set values of resistance are switched into a circuit, both the resistors and the switch contacts being in printed circuit form. For example, in the Avominor, a resistor group for the ohm ranges and range selector switch contacts are grouped on a single plate. The instrument also incorporates shunts for the various ranges in printed circuit form. By using these components the cost of manufacture was considerably reduced.

Although printed circuit resistors can be formed on

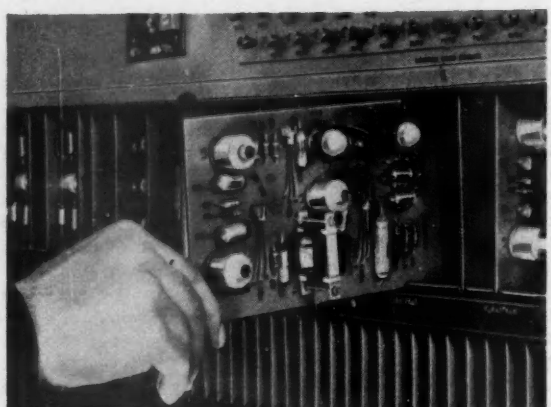


Fig. 3. A railway application of printed circuits used in the Westinghouse "Westronic" remote control and indicator system

s.r.b.p. or epoxy-resin-bonded backing materials, they are subject to a dissipation limitation to prevent damage by overheating. This is about 2 W/sq in. for s.r.b.p. and similar materials. Two techniques have, however, been devised to permit much higher dissipations. For the aircraft industry de-icing elements mats, typically with a base of neoprene can be formed to the most complex shapes and with dissipations up to 15 W/sq in. Not only can the mats be formed to meet the complex contours of aircraft wing sections, they can also have the circuit so printed that uniform heating is produced in conformity with the element shape.

The more significant development for the power engineer is the resistive circuit, printed onto a thin layer of insulating material and, in turn, bonded to an aluminium plate which acts as a heat sink. Such a construction can be used to give heat dissipations of up to 10 W/sq in. with the important features of great compactness and robustness. The printed circuit resistor with heat sink has been applied to such diverse applications as a foot control for a sewing machine incorporating a 54 W resistor and transformers with switches and resistors for the speed control of model railways.

Current Ratings and Conductor Spacing

Line width in inches	Current Carrying Capacity (amperes)					
	Temperature Rise					
	1 Ounce Copper		2 Ounce Copper		3 Ounce Copper	
	5°C	20°C	5°C	20°C	5°C	20°C
0·015	1·75	3	1·75	3	2	3·5
0·030	1·75	3	2·75	4·75	3	5·5
0·050	2·25	3·75	3·4	5·4	4·7	8
0·125	3·5	5·7	4·75	8·3	6·5	11

The copper weights correspond to 0·0015 in., 0·003 in. and 0·0045 in. copper laminate respectively. A clearance of 1 in. for 1 kV gives a general guide for circuit layout. For 440 V a.c. a spacing of 0·062 in. is adequate

Flexible Cables

Control gear manufacturers appear reluctant to apply printed circuit techniques to circuits using conventional contactor gear although there would seem to be possibilities for using printed circuits with logic components. However, for circuit interconnection, multi-strip cables are available which are quite thin, extremely pliable and resistant to damage by flexing. The cable may be formed either as a true printed circuit by acid etching copper from the backing material, or by mechanically forming copper foil into the insulant material. In either case "Melinex," a Terylene compound has been used with success. Because the strip conductor is only 0·002 in. thick, heat dissipation is extremely high compared with the equivalent circular conductor and current ratings from 2 A to 30 A are feasible. The conductor is enclosed in layers of Melinex, also 0·002 in. thick to form an extremely flexible cable yet suitable for 3 kV working. Connectors are available for use with these cables, which, by the mechanical process, can be manufactured in considerable lengths. It is also possible to "T"-off from such a cable by using a specially designed connector piece either soldered or riveted to the main cable. A typical application of these cables where they are subjected to severe conditions of flexing and with ratings up to 30 A is for the wiring control harness linking the steering handlebars to the chassis of fork-lift trucks.

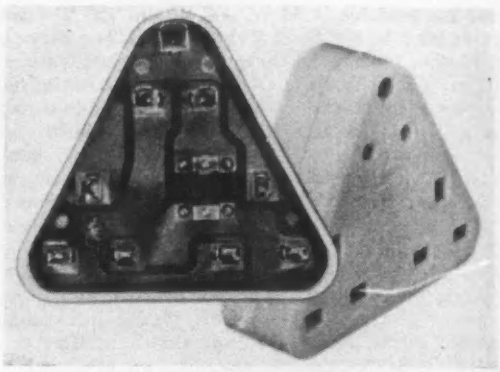


Fig. 5. Internal circuit pattern of the Grelco domestic adaptor

Printed Circuit Motors

The concept of a d.c. motor without an iron armature appeals to the control systems engineer because the motor is small compared with a conventional machine and has very low inertia. By using a printed circuit armature, it is possible to dispense with the core iron because the armature conductors are formed on an insulating plate, so thin that the air gap with the armature in position is little larger than that of a conventional machine. Printed circuit armatures suitable for motors up to 1 h.p. have been manufactured using a double-sided printed circuit with "plated through" connections. Six-pole versions of the

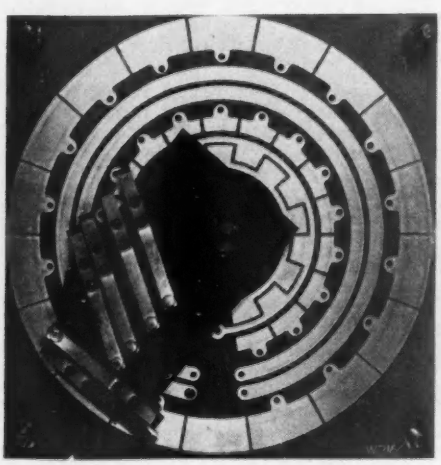


Fig. 4. Assembly of the Fuller on-load tap changer showing one of the printed circuit switch-plates

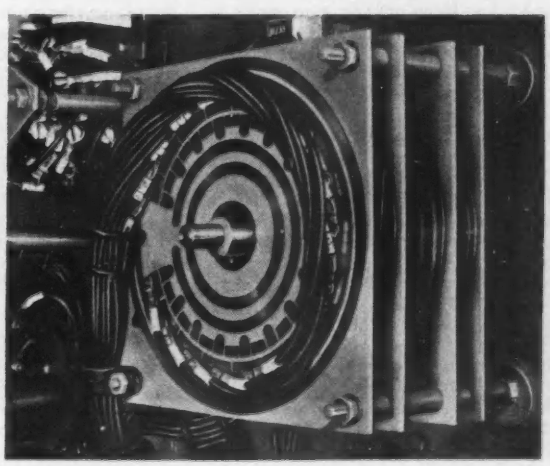


Fig. 6. Switch-plate for the Fuller on-load tap changer

motor are available in 30 W, 400 W and 750 W ratings, suitable for 3 V, 6 V or 12 V d.c. supplies. The motor has two brushes running on either side of the printed circuit armature disc. The disc runs between either ferrite rings, or a permanent magnet system. Motors so far constructed have a $\frac{1}{16}$ in. thick armature consisting of printed circuit windings on an epoxy resin impregnated base, but an armature with a thickness of only 0·005 in. is under development. Conventional d.c. winding configurations can be used. Sections of the armature conductor near the disc centre form the commutator. Connections between the two sides of the disc are made by punching holes through the insulating disc, coating the hole with a conducting layer of copper and then, if required, plating the complete armature circuit, including the linking hole. This is the "plated through" technique.

So far, the electronics industry has caught the main attention of the printed circuit designer, but it would seem that in the heavier current, though simpler circuitry field of the power engineer, there are considerable applications for these techniques. Control systems with logic units have been mentioned, mimic diagrams and automobile electrical systems suggest other applications. The printed circuit cable has also been tentatively used in a prototype transformer to take advantage of reduced size and weight. Essentially the wrapped round cable on the core formed a series of disc coils and by staggered linking of the cable foil ends a continuous winding was achieved. This development, although of interest, seems unlikely at present to compete with established winding techniques.

Chemical Milling

Allied to the processes used in printed circuits is the technique of chemical milling. The equivalent of stampings can be produced in almost any metal by coating them with an acid resistant film of the desired configuration and then dissolving away the unwanted metal. The technique is particularly suitable for small batch or prototype production of complicated shapes which, by normal stamping processes, would require a large outlay on tooling. The technique can be applied successfully to difficult metals as used for transformer cores with the added advantage that preferential grain properties are not destroyed as they are by punching. By judicious control of the etching process, sharp corners can be produced and undercutting can also be controlled. The method is also suitable for mass production as exemplified by the perforated cutting head shields for electric razors. In this application, controlled etching enables the minute perforations to be tapered through the metal foil even though it is only 0·002 in. thick.

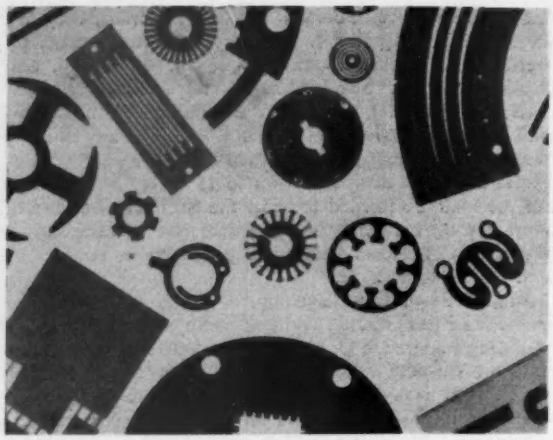


Fig. 7. A selection of components manufactured by chemical milling

This article is based on information supplied by Technograph and the assistance of the chief development engineer, Mr G. E. Short is acknowledged.

Royal Society exhibition

FROM the wide range of exhibits representative of current scientific research, 25 were chosen for the Royal Society Conversazione, held last Thursday at Burlington Hse. Several of the exhibits have direct application, or suggest a line for future development, in the field of engineering. Of immediate application is an investigation made at the NPL on the vibration of cylindrical structures, chimneys being an obvious example. The possibility of a chimney oscillating, even in a steady wind, is dependent on the natural frequency of the structure and the amount of damping inherent in the design. Oscillations result if vortices break away on alternate sides of a cylindrical structure. While this will not usually cause oscillations of a dangerous nature on concrete structures having a high damping factor, vibrations may become severe on steel chimneys, long pipelines and other cylindrical structures subjected to wind pressure. Research has demonstrated that the vortex breakaway can be prevented by attaching helical strakes to the structure. Some chimneys and transmission towers have already been so constructed and the principle will be used on a pipeline suspension bridge over the River Brahmaputra in India.

Two very different lines of research with applications in nuclear technology were on display. Examples of impervious graphite components suitable for operation in the high temperature gas reactor were exhibited with illustrations of such future developments as an all-graphite thermocouple and specimens of synthetic carbon with unusually good electrical conductivity.

High-speed counters requiring negligible operating power have been developed for nuclear particle counting and for use in computers. The counters have been built into decade boxes with a counting speed of up to 10^6 pulses/sec. Individual counting units are formed by depositing a film of nickel-iron alloy, only 8 millionth to 60 millionth of an inch in thickness, on to a fine-bore copper tube in a magnetic field. The field orientates the alloy film molecules to give a characteristic rectangular hysteresis loop which has bistable magnetic properties. By arranging the elements in cylindrical groups of ten, with a central magnetic needle, a decade counter is formed which requires no power to maintain the indication.

That plant roots respond to the effects of a strong magnetic field in a relatively short time has now been proved. A seedling root can be deflected away from its normal direction of growth if it is so placed that the root axis is perpendicular to a steep magnetic field gradient. The root curves under the influence of the field towards regions of lower magnetic density.

Research on the combustion of single particles of pulverised fuel and single drops of fuel oil are being undertaken at Sheffield University. By using a 5 ft mirror system, temperatures up to 3,500°K can be produced indirectly without contamination being caused by the arc products. The combustion of the fuel particles is observed by direct shadow projection and the temperature of the enveloping gas can be detected by the Schlieren image.

Among other exhibits shown were electrolytic machining apparatus designed to reduce the thickness of a metal specimen uniformly to form a very thin film, and apparatus for producing thin-walled copper spheres by electro-plating.

Cable research

MCFADZEAN LABORATORY OPENED

THE McFadzean Laboratory, opened on Tuesday by HRH the Duke of Edinburgh, provides a new centre for the physical and allied research departments of the BICC organisation.

The laboratory will undertake long-term experimental work at the request of individual engineering laboratories in the group and also basic research. Four of the BICC organisation's ten experimental departments will be based on the new laboratory—the instrumentation and control, physics, diffraction and microscopy departments and also British Dielectric Research Ltd. Some of the work on which the organisation is currently engaged is outlined in this article.

Fig. 1. The north front of the McFadzean research laboratory of the BICC group at Wood Lane. The laboratories were opened officially on Tuesday by HRH The Duke of Edinburgh

Instrumentation and Control

Work in the instrumentation and control department is concentrated on developing new measuring techniques for use in the factory, particularly for non-destructive testing, and also devising automatic production equipment. For the non-destructive testing of rubber and plastics cables insulation, d.c. spark tests of very low energy are being developed. They have advantages over the a.c. spark-testing techniques which have been in use for a number of years and are also non-lethal. In conjunction with the d.c. tester, a breakdown recorder has been developed which records, on a paper tape, units of cable length and the corresponding position of any breakdowns detected.

For the quality control of copper and aluminium wires and tubes, an electromagnetic tester is in course of development. The tube or wire under supervision passes through a coil which induces eddy currents in it. Any flaws cause the distribution of these eddy currents to be disturbed, and these disturbances can be detected by a pick-up. By filtering out background noise, an indication is obtained only when a flaw passes through the detector head.

Development of production techniques for rubber cables and the vulcanisation processes used can be studied on a small scale by a flash vulcanising unit which enables the fast vulcanising processes used in the factory to be studied on samples. The application of automatic production techniques to the cable and wire industry is exemplified by a demonstration model of an enamel wire-drawing process line. Among the techniques for such processes developed by the laboratories are the electromagnetic flaw-detector, already referred to above, and an automatic storage machine. This device ensures that, in a continuous wire-drawing plant, no interruption is necessary when wire on the parent reel is exhausted and has to be joined to a new reel. A rotating storage reel is brought into operation as the original parent reel is nearing exhaustion. This special machine stores sufficient wire to enable the process in subsequent stages to be uninterrupted while the butt-welded joint between the old and new wire is made. Constant tension, an essential requirement of the wire-drawing process, is maintained both while the wire is being taken on to the storage reel and during the jointing process. At the beginning of the process line, constant tension is obtained by a brake incorporating a three-phase induction motor with suitable torque characteristics, which operates in the plugging region. Another device developed in the laboratory is a reeling machine, for use at the end of a production line, which ensures even layering of the wire on the reel. It also includes a simple calliper device which measures the distance between reel cheeks and sets limit

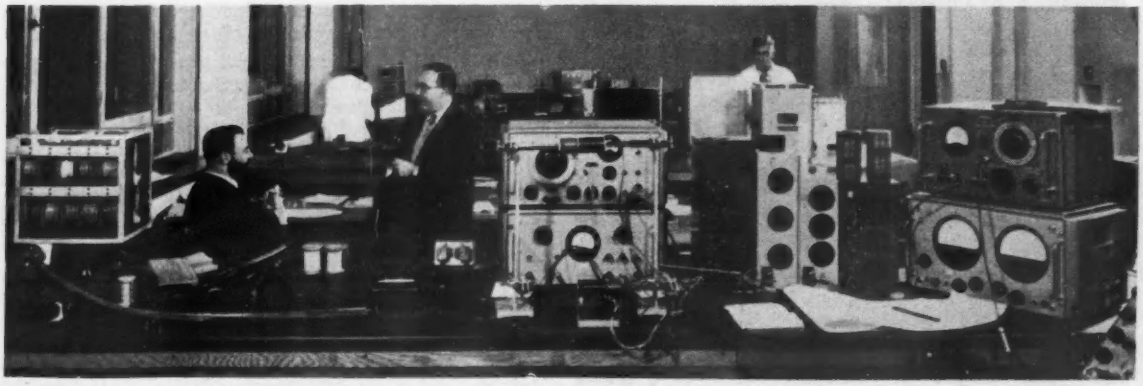


Fig. 2. The spacious layout of the building is evident from this view of the instrumentation and control laboratory

switches so that the full drum width is filled uniformly by the wire-feeding mechanism.

The recent contract obtained by BICC for the Magna natural gas flexible pipeline which will link Vancouver Island to British Columbia has raised a number of technical problems. The pipeline consists essentially of a cable sheath without the cable, but with an internal steel tape spiral. Uniformity of the lead sheath during extrusion is an essential requirement and to record this a gauge has been developed which checks the thickness continuously. In essence, it consists of a sensitive pick-up coil which is rotated around the extruded sheath at constant speed, so following a helical path on the sheath. Undulations in the sheath formation are recorded on a chart.

High-voltage Cables

Although considerable development work is directed to the application of plastics to cables, a major part of the work of the physics department is concerned with improving the properties of paper as a dielectric, particularly for extra high-voltage cables.

For the convenient study of the effects of paper composition on its dielectric properties, a complete Fourdrinier paper machine has been installed in the laboratory. The machine can produce a sheet of paper, varying in thickness, in width, up to about 5 in. Sample cables can then be prepared and tested in the high-voltage sections of the department. One line of investigation is the manufacture of paper using only deionised water, a possibility of importance for the development of e.h.v. cables.

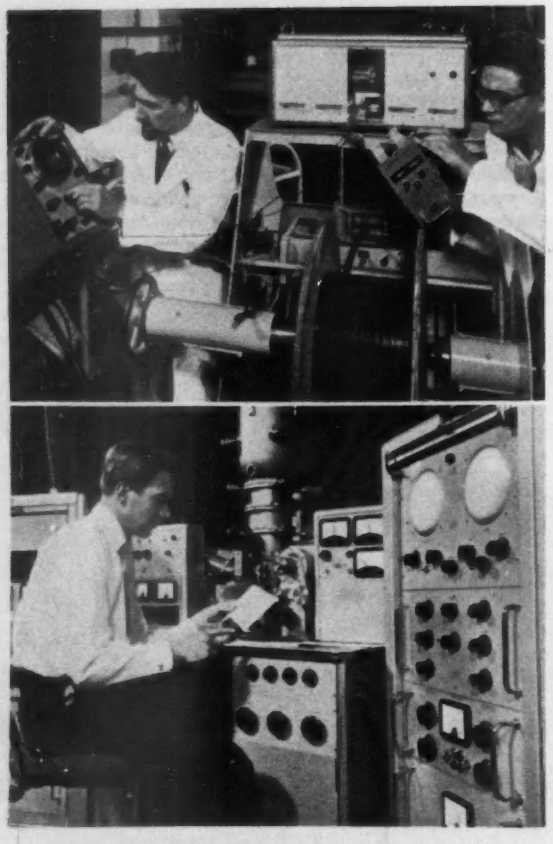


Fig. 3. Above, setting-up part of an automatic strip winding machine and below, the X-ray scanning micro-analyser in the diffraction and microscopy department

The strength of cable paper is also studied, and various test machines have been adapted or developed for such purposes as measurement of the depth of indentation in the surfaces of paper. Voids in a paper dielectric form a site for discharges to occur, and measurements on typical papers have shown that depressions of 0·00075 in. may occur frequently, even in a paper only 0·003 in. thick.

Other studies are concerned with the life of sample cables under repeated impulse discharge and the ability of both paper and plastics dielectrics to withstand mechanical handling in service.

Capacitor Development

Research on capacitors of all types is carried out in the laboratories by British Dielectric Research Ltd., a company serving the Capacitor Division of BICC and the Telegraph Condenser Co. The work embraces oil-impregnated paper, electrolytic and metallised plastics and ceramic capacitors, but of particular interest is an investigation into capacitor dielectric materials for energy storage capacitors. These units are used in thermo-nuclear research and are subjected to an unusual duty cycle requiring charging to a high d.c. voltage with subsequent rapid discharge.

The measurement of ionisation in paper capacitors and how it is influenced by pressure is also under investigation. Vacuum-metallised plastics films demonstrated enable very compact capacitors to be manufactured with the important advantage that, if the dielectric is punctured, it is self-sealing and the capacitor remains almost unaffected.

The remaining sections of the laboratory contain rather more exotic equipment. In the diffraction and microscopy department the structure of materials is under study, using an X-ray micro-analyser and an X-ray diffraction camera. An electron microscope is also installed. In connection with the work of laying the cross-Channel cable, calculations are being completed on the laying programme, using an Elliott electronic computer. The computer is also in use for designing minimum-cost overhead line towers and the calculation of sag/tension data.

Building and Services

The McFadzean laboratory is a six-storey building, designed in the modern style, providing a floor area of 64,000 sq ft. Most of the building is devoted to air-conditioned laboratories, although it also contains a large assembly hall and canteen accommodation. The ventilation system is designed to effect six air changes per hour with some recirculation and is unusual in being controlled automatically by the sun's heat. On the south side of the building, a detector on each floor operates dampers to divert more air to that side as the temperature rises.

A feature of the basement service system is the provision of a plant control console which enables the heating, air-conditioning and other plant to be either hand or automatically controlled. The electricity services are derived from an incoming 11 kV feeder to a basement substation. The services are distributed to the laboratories through ducts beneath the window sills, which include 100 A, three-phase, four-wire continuous busbar trunking. Service points provided on the laboratory benches are for single- or three-phase sockets and an earthing tape is included in floor trunking. The laboratories are lit by fluorescent ceiling battens containing four 80 W tubes and giving 30 lumens/sq ft. Flush Perspex panels, lit from above by twin 20 W tubes, provide illumination in the corridors on each floor, and decorative fittings have been installed on the staircases and in the entrance hall.

BRITISH TRADE FAIR

ON Friday the British Trade Fair in Moscow opens, offering to Soviet engineers and technicians an opportunity to see the latest achievements in British technology. The importance of this fair in East-West trade justified the President of the Board of Trade, the Rt Hon Reginald Maudling, visiting Moscow in order to open it. Primarily designed to encourage exports, the fair is open for 17 days, and during that time an estimate has been made that more than a million Russians will be able to see Britain's products. Sponsored by the Association of British Chambers of Commerce and the All-Union Chamber of Trade of the USSR, the fair occupies a site of some 228,000 sq ft. A reciprocal Russian fair will be held at Earls Court from 7 July to 29 July.

The main electrical exhibits are staged in the second largest pavilion, a fan-shaped building constructed largely of steel and glass, one of the four exhibition halls. Here a variety of equipment is on view, ranging from a 620 kVA mobile generating set to electric fires.

Emphasis on Industrial Plant

Emphasis is being laid on industrial equipment rather than domestic appliances. Focal point of the 3,500 sq ft AEI display is a specially commissioned mural depicting electricity's place in the modern world. This stand is in six sections, generation and supply, industrial utilisation, transport, domestic equipment, scientific apparatus and research. Among the models on show is one of a 5,000 kW mobile generating unit, several of which have already been sold in Russia. Also on the stand is a spark source mass spectrometer, two of which have been ordered for use in the USSR nuclear research programme. Domestic appliances are represented by Hotpoint refrigerators under their export name of Gala.

Magnetic and Electrical Alloys' display with title in Russian

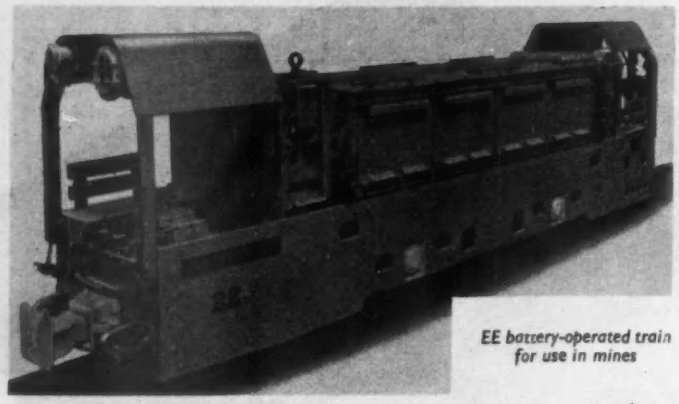
Imposing feature of the Allen West stand is an 18 ft glazed tower with a system of revolving shelves surmounted by the company's emblem. In the standard starter range is a plug-in unit with easily interchangeable interior, for general industrial use.

Crompton Parkinson are participating as a member of the Rustyfa consortium. They are showing fractional h.p. motors for single- and three-phase operation in light and heavy duties and for special applications. A wide selection of measuring instruments includes examples of the Crompton "New World" range of industrial switchboard instruments designed for a wide-angle view with a dial free from parallax and shadow. One of the highlights is a Banbury Mixer by David Bridge and Co. which is driven by a 300 h.p. CP slip-ring motor.

Three Miles of Cable Supplied

Three miles of p.v.c.-insulated, armoured power cable with accessories has been supplied by BICC for the exhibition. Special metals and their applications in transformers and electrical instruments are the subject of group display, together with a range of thermostatic bi-metals and selection of glass to metal sealing alloys. Also featured are cold rolled silicon iron cores for transformers and chokes made by Telcon Magnetic Cores.

Models of both the transportable and fixed-site Proteus-powered 3 MW generating sets are one of the central displays by Bristol Siddeley. This 3 MW turbo-generator has been developed as lightweight plant to meet peak load requirements of supply authorities as well as emergency supplies. Another model on show is the Maybach MD 870 diesel engine used to power a 1,200 kW generating unit mounted on a single skid frame.



EE battery-operated train for use in mines

Fourteen basic engine types covering a power range from 1½ b.h.p. to 4,400 b.h.p. are being exhibited by Fuller Electric and Brush Electrical Engineering in conjunction with Hawker Siddeley. A large-scale model represents one of the two auto-transformers rated at 180 MVA, 275/132 kV which Fuller have built for the CEGB's supergrid substation at Canterbury. Brush are showing a ring main unit, one of a series of weatherproof units for use on 3·3 kV to 11 kV systems. They are also displaying a transformer specially designed for use in mines, the stator and rotor of a non-breathing flameproof motor and a flameproof electric truck powered by 12 lead-acid cells.

Board of Trade Exhibit

British achievements in the fields of science and technology are being shown to the Russians by the Board of Trade; 10,000 sq ft shows how the Government, universities, hospitals and private industry work together with the common goal of research. Space research, much in the news lately, deals with the work of Professor Lovell and the tracking station at Jodrell Bank and research by Martin Ryle with the radio telescope at Cambridge. The Atomic Clock, for which Dr Essen, of the National Physical Laboratory, was awarded the USSR Popov medal, is set in a display illustrating its principles and practical applications.

The Crusilite electric furnace element is a one-piece silicon tube by Morgan Crucible Group in which the hot zone is produced by cutting a spiral in the central portion. With this a temperature range up to 1,575°C is obtainable. Non-linear silicon carbide resistors for lightning surge diverters, surge limiting and improvement of relay sensitivity are also among exhibits in this display.

Featured by George Kent is the new "Transdata" system of comprehensive measurement and process control. It uses interrelated electronic "building blocks" of modulated construction which can be built up to give a wide variety of circuitry. Practical examples of the latest measuring techniques and applications are the basis of the exhibit. Electronic instrumentation includes examples of a strip-chart recorder for the measurement of temperature, current and millivolts. A further plug-in unit is a quadrature suppressor for the measurement of a.c. signals.

Faced with the difficulty of showing their products to the best advantage, Midland Silicones have overcome the problem by staging a static display with photographic illustrations. Their aim is to inform the Russians of the advantages and applications of silicones, and to this end the company have had four publications specially written and translated for the occasion.

Equipment for Russian Jet

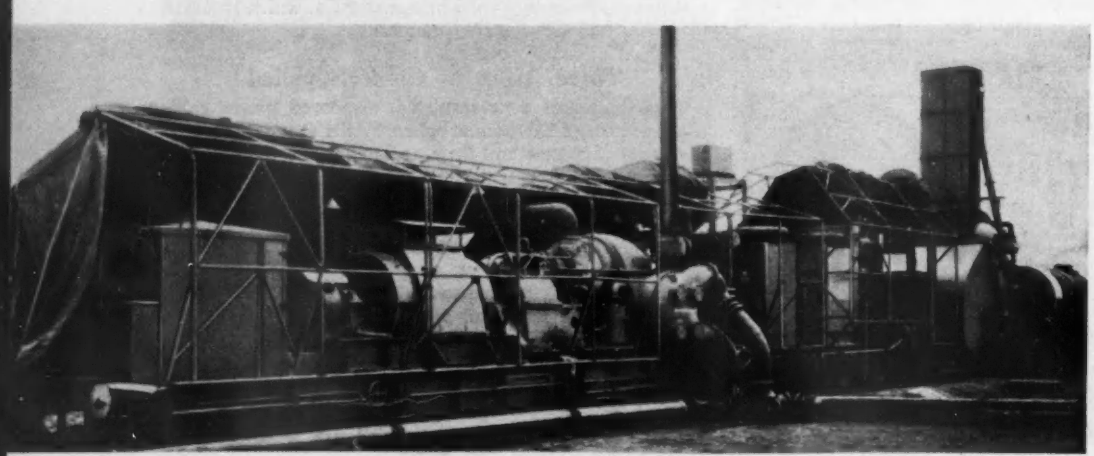
What was the longest open wire carrier telephone system in the world between Moscow and Khabarovsk was supplied to Russia in 1939 by Standard Telephones and Cables. More recently they equipped the Aeroflot TU104 jet aircraft fleet with radio communication equipment. Their range of submarine communications equipment is represented by sections of cables and underwater repeaters.

Erskine Heap have exported motor control gear for boiler installations and a variety of switchboards to the USSR. Examples chosen for the exhibition are representative of their ranges and illustrate switchgear such as vertical isolation switchboards and flatback switchboards.

Enfield Rolling Mills, who are exhibiting in conjunction with their associated companies, are offering the Russians many non-ferrous metals and alloys. Principal among their exhibits are commutators and slip-rings for electric motors.

Three Hundred Exhibits on EE Stand

More than 300 exhibits typical of products from the group's 12 UK factories make up the English Electric display. They are designed to show the wide range of work being done, from a 500 MW nuclear power reactor station



Rear view of an AEI 5,000 kW oil-fired mobile power station

Aeroflot TU104 for which STC provided radio and navigational equipment

in scale model to the smallest electronic valve. One of the main features shows the five types of prime mover for power generation, nuclear, steam, water, diesel and gas. A complete working Marconi outside broadcast vehicle using four of the latest television cameras is bringing pictures of the exhibition hall to a TV studio on the stand. The domestic side of the company's activities is represented by a kitchen with an automatic home-laundry unit, time-controlled cooker and deep-cold refrigerator. There is also a model of a 350 MW single-shaft steam turbo-alternator set similar to the one to be supplied to the CEGB's Drakelow station.

Making its debut simultaneously in Moscow and Great Britain is the Telequipment amplifier designed for use with oscilloscopes. Another of the company's models is the Serviscope, which is said to be ideally suited for work at the highest video frequencies as an oscilloscope.

Returning to Moscow for the second time in 12 months are Cambridge Instruments, who were exhibitors in the British Scientific Instruments exhibition in the Polytechnic Museum last June. Among the instruments is a new development, the multi-point boiler water analyser, capable of recording on one chart the results of up to 12 measurements of different variables in boiler water. Other exhibits include a quick-acting electronic recorder and an electronic recorder with 66 set-up ranges.

A representative selection of switch and fuse gear by Midland Electric Manufacturing includes the recently introduced ranges of "Memrex-Exel" and "Exel" 500 V switchgear with sheet steel enclosures and front operating switch handles. In addition to the ranges of switchgear, protective motor control gear for motors from ¼ h.p. to 25 h.p. are shown, together with electrical wiring accessories for industrial and domestic use.

A standard geared unit comprising a squirrel-cage 35 h.p. motor is the contribution of Lancashire Dynamo; and Crypto and Foster Transformers, another company in the group, are showing a 500 A primary current injection test set housed in a portable ventilated sheet steel case designed to give continuously variable output current by means of a Foster voltage regulator. The Lancashire Dynamo Nevelin Company have supplied heavy industrial switchboards, motor starter boards for conveyor systems and fuse distribution boards as being representative of their products.

Diversity in specialisation is the theme of the Pye Group, which features ground instrument landing systems for airfields, equipment which has already been sold to Russia and installed in Moscow's Vnukovo and Scheremietievo airports. Telecommunications equipment and navigational aids are also featured.

Four companies in the Turner and Newell Organisation are exhibiting jointly. Among these, Turner Bros Asbestos focuses attention on the wide range of asbestos textiles, jointings, conveyor, elevator and power transmission beltings. As well as these, they are showing plastics reinforcement materials.

In addition to the range of instruments by Avo is a Douglas large multi-winder with electronic programme control. This is a coil-winding machine to which a programming unit has been added. It operates by a light source showing through a punched metal tape and is suitable for application in complicated design such as transformers having many tappings or pyramid-wound coils.

Advances in Electronics

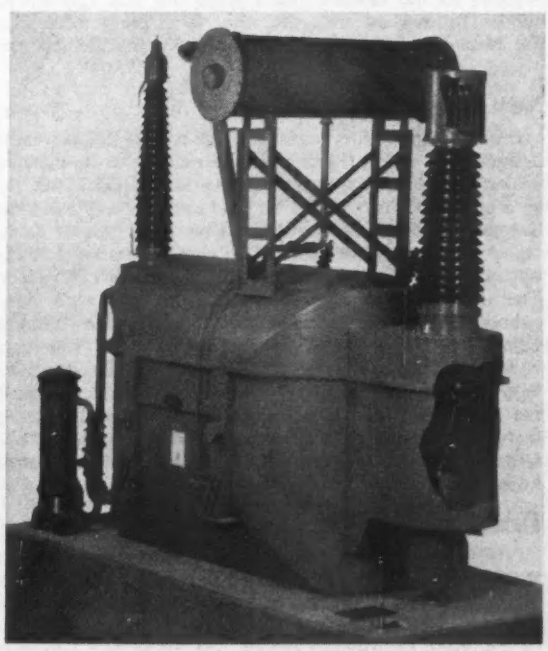
Newest British electronic equipment, some of it never yet shown publicly, underlines UK technical progress. Cossor are showing an oscillograph, Model 1087, a precision-built, split-beam instrument. Two identical calibrated amplifiers are used for vertical deflection, the sensitivity continuously variable between 0·1 V/cm and 10 V/cm over a bandwidth of 1 c/s to 10 Mc/s.

The Panellit 609 information computing system is featured by Elliott-Automation Systems. This system provides the facilities of a digital computer specially adapted to the control of industrial processes.

Two devices shown by EMI Electronics are for use in electric motor manufacture. One of them is a commutator undercutter machine and the other is applied to the accurate balancing of rotors.

Electronic measurement apparatus for telecommunications provides the theme of Marconi Instruments, whose newest instrument is a standard signal generator covering the range of 10 kc/s to 72 kc/s.

An automatic co-ordinate positioning machine, working to accuracies of 0·002 in., is shown by Mullard. It is said that by using this machine an unskilled operator can produce work of a higher accuracy than a skilled man using conventional methods of marking out and drilling, in one-tenth of the time.



Working model of an on-load tap changer by AEI mounted on a single-phase transformer

NOTES ON WIRING

BY MEGOHM

I NOTE from the pages of my morning newspaper that yet another kitchen planner is airing his views with regard to electricity in that rather sacred room in the house. This latest inspiration, as far as I can decipher from the writings, is designed to change an old kitchen into a modern one, or provide a kitchen on one wall of a room by fixing a contraption to the wall. The basic unit is something like a box which, when fastened to the wall and with the doors pulled aside, forms a working bench complete with a basin and waste disposer sunk into it and a dishwasher, water heater, roasting spit and refrigerator fastened to the back wall of the unit. Of course, there is other electrical apparatus lying loose on the counter, such as a toaster, frying pan, percolator, etc. etc.

Now to me the idea seems reasonably good but I felt the whole thing gave the wrong impression to the reader. Mention was made of the cost of such a thing, £300 equipment included. But, of course, the equipment can be bought separately and a list showed the prices of that equipment. The total was £299 but I could not see any reference to any wiring or sockets. Very quickly I counted up the sockets required and they came to eighteen in number.

This number of sockets sited within an area of about 6 ft by 4 ft presents no problem to the engineer but to suggest to the ordinary householder that such an arrangement can be made up at home, is surely asking for trouble. I can well imagine some of the methods employed in doing such a job.

It is, however, quite interesting to note that at long last people are beginning to realise the number of sockets required in the kitchen and I hope that the speculative builder follows on with the idea. It is really time that this business of installing two sockets in the kitchen was ironed out.

New Type of Cable

I was recently shown a sample of a new flexible cable designed to combat troubles experienced at immersion heater positions. Engineers have various ideas about the type of cable which should be used and in many cases the ordinary asbestos cable is decided on. This type of cable, being rather stiff, can cause loose connections (as I found out in my own home) and consequently arcing takes place. The new cable has the conductors insulated with butyl rubber, cotton filled and cotton braided, the braiding being finished with a fire-resisting lacquer. The core is rated at a maximum temperature of 85°C. Besides being very suitable in situations where there is a fire hazard, the cable prevents moisture doing any damage. I feel that this cable should prove most useful to the contractor who finds himself involved in the installation of immersion heaters.

Drawing Board Light

Visiting a contractor the other day I was rather taken by the excellent lighting provided over two drawing desks. Apparently this contractor had seen this new type of desk light at an exhibition and purchased two types to try out in his office. Of Swedish design, one fitting had two short fluorescent lamps in it and the other had a tungsten lamp fitted. I experimented myself with each fitting and was most impressed by them, especially the ease with which the fitting could be adjusted to the position required. The fitting has a clamp so that it can be attached to the edge of a desk or drawing board. A very useful and elegant fitting indeed and a boon to the electrical draughtsman who has to work on complicated wiring circuits.

Another Report from NICEIC

I have just received an extract from the records kept by the NICEIC on this problem of earthing. During the first quarter of this year 57 cases of ineffective earthing were recorded together with 39 cases of inoperative earth-leakage circuit-breakers. I have myself recently been involved in this matter of earthing to such an extent that I can hardly bear to say the word, far less discuss it.

One common installation fault is, according to the report, diminishing and that is the number of deviations from Regulation 207(G) which covers the total enclosure of wiring connections to accessories and other equipment. This is rather encouraging news but it still amazes me that so many contractors continue to drill and erect wooden blocks at ceiling rose positions when it is so easy, and more economical, to use one of the plastics pattresses. Surely when time spent on a job means money, the time saved in drilling blocks must be a real economy.

Garden Danger

Now that the good weather is with us I note that more electric lawn and hedge cutters are making their appearance. Walking off my Sunday lunch recently, I was taken by surprise to see an object hanging from a tree, an object I recognised as an electric socket suspended on a length of cable. I looked around a bit more and traced the other end of the cable hanging alongside a bulkhead fitting fixed on the face of the garage close by. I can only assume that the contraption was used to serve an electric hedge clipper and the house was so quiet I wondered if it had claimed the owner as a victim.

Farther along the same road I came across a garden, a very lovely garden I might add, which was fitted out with floodlighting and flower-bed lighting. Risking the attentions of a large dog which was running loose, I had a good look at the wiring and found it extremely well done, great care having been taken to guard against dampness, etc. The earthing arrangements were equally praiseworthy. Care had been taken to bond the earth wire on to the spikes and lanterns. By this time the owner had appeared either with the intention of throwing me out or rescuing me from the dog, and on hearing that I was merely admiring his garden lighting he showed me it all in detail. I could find nothing wrong with it at all and I congratulated him on the whole thing. He then reached into a box and handed me a leaflet which had come with the fittings. Curiously enough, I commented on this very leaflet when I described my visit to the Engineers' Exhibition (ELECTRICAL TIMES, 6 April, 1961). The leaflet advised that a competent electrician be employed in the wiring up of these garden lights. Rather cheerfully, I returned home to push my non-electric mower up and down my lawn.

Changes at the N.P.L.

NEW ACCOMMODATION, FACILITIES, PLANS AT TEDDINGTON

ONCE again, open-day at National Physical Laboratories, Teddington, has come round. This year, visitors were able to note rather more changes than on previous occasions. Technically, the most significant is a general shift of activities back towards the original objective of the laboratories, standardisation and basic research, with a transfer of much applied work in special fields to other organisations working in close association. For example, increased facilities for applied aerodynamics at the RAE, Bedford, and in wind tunnels of aircraft companies has enabled the former duplex tunnel, completed in 1921, to be dismantled and the building converted to provide canteen facilities, on a scale better suited to the present number of staff, more adequate lecture halls and a conference room.

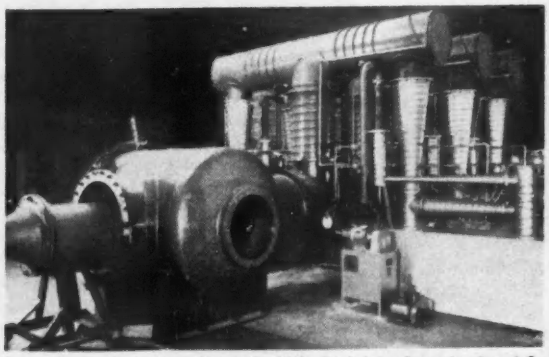
Glazebrook Hall

The reconstructed building has been named after the first director of the Laboratories, Sir Richard Glazebrook, and has now a new floor level, 21 ft above the ground, approached by two flying stairways at each end of the canteen area on the ground floor. Here a lecture theatre, conference room and reading room have been located. The lecture theatre has seating for 384 persons in stepped tiers and is equipped with a projection and recording room, simultaneous translating facilities and provision for controlling the lighting from the stage as well as from the projection room.

The conference room, 35 ft by 26 ft, is used for small lectures and conferences and incorporates relaying features from the main theatre when acting as an overflow area.

High-voltage Laboratory

Visitors this year were unable to experience the usual display of high-voltage phenomena, the equipment having been transferred to the CEGB laboratories at Leatherhead, where, in association with the ERA, future research will be centred. The vacant building is scheduled for a Van de Graaf generator as a main step to building up equipment for general standards work on radiology. At a future date a research reactor may be added.



One of the new wind tunnels at the NPL which have been developed for the study of supersonic flows at great altitudes

The new lecture theatre in Glazebrook Hall will seat 384

At Feltham, important research is under way into the study of ship behaviour in oblique seas, while the water tunnel, barely completed for last year's visit, is now fully occupied in a study of cavitation in collaboration with other laboratories at home and abroad.

Length of the Metre

Another step in international standardisation has been taken with the decision of the Eleventh General Conference on Weights and Measures last year, to base the standard length of the metre on the wavelength of Krypton-86, it having been established that this line in the spectrum is sharper in definition than any other. The standard length of the metre is now accepted as being 1,650,763·73 wavelengths of the orange line of Kr-86, and the NPL has installed the equipment which will enable determination to be made with an accuracy approaching one part in a thousand million.

High-pressure Physics

Another fresh field for study is that of high-pressure physics, where pressures up to 100,000 atmospheres at low and at high temperatures cause profound and permanent changes in many materials. Among the studies already carried out have been the discovery of the abrupt change from semiconducting to conducting metallic state of indium antimonide at 30,000 atmospheres, room temperature.

The Aerodynamics division is still equipped to study fundamentals of flight at supersonic speeds and high altitudes, for which work new wind tunnels have been devised and constructed. These include a low-density tunnel capable of operating at speeds of up to Mach 10, the air being accelerated from rest by expansion in a convergent-divergent nozzle exhausting to a vacuum maintained by powerful pumps.

Personalities *in the industry*

Lord Gridley

Mr J. H. Thornton

Mr W. Bolton

Mr E. E. Dweck

Mr R. Dell

Previously district engineer in the Manchester Central District of the North Western Electricity Board, **Mr W. B. Elliot,** B.SC., A.M.I.E.E., A.M.C.T., has been appointed district commercial engineer for the Manchester South District, succeeding **Mr J. L. Pearce.** (*ESH, pages 156, 157.)

Chairman of Southern Areas Electric Corporation Ltd. for more than 25 years, **Lord Gridley,** K.B.E., M.I.E.E., has decided to relinquish that office before the next annual general meeting of the company, but he proposes to remain on the board in an executive capacity as a director-consultant. Lord Gridley's long association with the electrical industry goes back to the beginning of this century when he was with British Electric Traction Co. Ltd., and he has since been actively concerned in promoting and managing electric power and traction companies and manufacturing undertakings both at home and overseas. He was assistant manager of the Newcastle Electric Supply Co. from 1905 to 1906, and was then director and general manager of the Cleveland and Durham Electric Power Supply Co. until 1916, when he was appointed controller, electric power supply, at the Ministry of Munitions. In 1921 he became general works manager of the English Electric Co., a position he held until 1927. He subsequently became a director of various electrical companies and first joined the board of the newly formed Southern Areas Electric Corporation Ltd. in 1934. That concern then operated a number of electricity supply undertakings such as the Seaton and District EL Co., Brentwood District Co., and Peacehaven EL and P Co., in addition to Mawdsleys Ltd., the plant manufacturing concern. The electricity supply undertakings have since been nationalised but the company has expanded considerably in the manufacturing sphere under Lord Gridley's guidance. He was also a member of Parliament from 1935 to 1955, representing Stockport and Stockport South, and was a member of the Standing Committee which dealt with the Electricity Bill in 1947.

Mr J. H. Thornton, M.I.C.E., has been appointed group resident superintendent for the 580 MW nuclear power station at Sizewell, Suffolk, which is being built for the CEGB by the English Electric-Babcock and Wilcox-Taylor Woodrow atomic power group. Mr Thornton was chief civil engineer in the Group Resident Superintendent's Department at the 500 MW nuclear power station at Hinkley Point, which the group is also building for the CEGB, from December, 1957, to December, 1959, and from then until 1 Feb. this year has been assistant group resident superintendent. From 1946 to 1957 Mr Thornton was senior engineer and resident engineer with Sir William Halcrow and Partners on the design and construction of hydro-electric projects for the North of Scotland Hydro-Electric Board.

Previously with Ferranti Ltd. and Simplex Electric Co. Ltd., **Mr A. W. Bates** has joined Triplan Thermal Acoustics Ltd. as technical director.

Mr W. Bolton, A.M.I.E.E., whose appointment as engineer in the Thurrock district of the Eastern Electricity Board we briefly noted last week, has been first assistant district engineer at Guildford, with the South Eastern Electricity Board, since 1957 (*ESH page 107). Mr Bolton succeeds **Mr D. J. Agnew,** A.M.I.E.E., who has been promoted to district manager, as we earlier reported. Prior to joining SeeBoard in 1957 Mr Bolton was with the Eastern Board at St. Albans and Welwyn Garden City as a second assistant engineer. He received his early training with the former Northmet Power Co. and technical education at the Northampton Polytechnic. After four years with the Northmet Company as a junior engineer, he joined the staff of Smiths Instruments, Cheltenham. Subsequently he worked as a senior test room assistant with Muirhead and Co., and then rejoined the Northmet Power Co. as an assistant engineer at Wood Green.

Mr Eliot E. Dweck, L.C.S., A.M.I.E.E., has joined the Westrex Co. Ltd. as head of the Projects Division. Previously Mr Dweck was engaged on special investigations into advanced problems of radar and computing equipment for Decca Radar Ltd., and earlier was a departmental head in the Nelson engineering laboratories of English Electric Co. He has published various papers on tensors for circuits.

London Transport announces that **Mr R. Dell,** O.B.E., M.I.E.E., M.I.MECH.E., M.I.R.S.E., has been appointed a chief officer of the London Transport Executive with the title of chief signal engineer. He will act under the general direction of Mr C. E. Dunton, M.A., M.I.C.E., chief civil engineer. In addition, **Mr W. H. Challis,** M.I.R.S.E., principal executive assistant to the signal engineer, has been appointed an officer of the Executive, with the title of signal engineer, reporting to the chief signal engineer and acting as his deputy. Mr Dell joined London Underground's Signal Department as an apprentice in 1915. He became new works assistant in 1922 and outdoor assistant (new works and maintenance) in 1925. After the formation of the LPTB in 1933 he was promoted to assistant signal engineer (construction) and in 1936 became an officer of the Board. Mr Dell became joint signal engineer in 1940 and signal engineer in 1942. He has been responsible for the

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* *Denotes revision to the "Electricity Supply Handbook, 1961."*

design and introduction of many important signalling developments on the London Underground system and has taken out a number of patents for inventions connected with signalling equipment. Mr Challis has been principal signalling assistant since 1950, joined the staff of the Metropolitan Railway in 1915 and has been actively concerned with all the developments that have taken place in signalling on London Transport.

Mr C. S. Stockton, DIP.M.I.E.S., has been appointed a lighting engineer for the South East Region of Philips Electrical Ltd. A further appointment announced is that of **Mr H. E. Chadwick** as a lamp and lighting group representative in Berkshire and parts of Hants and Surrey. For the past 18 months Mr Stockton has been in charge of the region's lighting design office after a spell in the head office. Mr Chadwick was formerly an electrical appliances group representative in the region. He has taken over from **Mr Harry Crossley,** who has been given a sales promotion assignment in connection with the new Gala domestic lighting fittings.

Mr K. C. Brigden, A.M.I.E.E., has joined Berry's Electric as manager of the company's new factory at Bletchley. Mr Brigden, who served his engineering apprenticeship with the British Thomson-Houston Co. Ltd., has held appointments with a general engineering company in the Midlands, with a firm of management consultants and in the electricity supply industry.

Two new district engineers have been appointed by the London Electricity Board. **Mr C. G. Kirkwood,** A.M.I.E.E., is to join the East End District in that capacity on 1 June, in place of **Mr N. L. W. Hills,** B.SC.(ENG.), A.M.I.E.E., who has this week moved to a similar post at the Board's Eastern District, succeeding **Mr H. A. Phillips,** who retired last Friday. (*ESH, page 81.) For the past seven years Mr Kirkwood has been a technical officer in the Chief Engineer's Department, Design and Planning Branch, at Lesco House following service with the Western Sub-area Design and Planning Branch since 1948. He gained a Faraday House diploma with honours and received practical training with G. D. Peters and Co., the St. James and Pall Mall Electric Light Co. and Kingston upon Thames Corporation. He then joined Central London Electricity Ltd., and during the war was an experimental assistant with the Admiralty Anti-Submarine Department at Portland. Afterwards he served with Erskine Laboratories Ltd. for a short time before returning to Central London Electricity, Belgravia District, as distribution engineer, and in 1948 transferred to the St. James District. Mr Hills started his career with Eureka Electric Ltd. and joined the City of London Electric Light Co. in 1938, and after war service as electrical lieutenant, RNVR, was assistant engineer (operation and maintenance) with the Board and moved to the Northern sub-area as testing engineer in 1949. Three years later he became City district engineer, a position he held till 1959. Mr Phillips was with the West Ham Electricity Department from 1919 until 1948, latterly as deputy distribution superintendent. He then became construction engineer and in 1957 was appointed to the position from which he has just retired.

Mr R. Pearson has been appointed sales engineer to Bailey Meters and Controls Ltd. for Scotland, Northumberland and part of County Durham.

The Merseyside and North Wales Electricity Board announce the appointment of **Mr W. A. Gibson,** D.P.A., as their establishments officer. Mr Gibson has now taken up his new duties. The former establishments officer, **Mr E. A. E. Colter,** resigned his appointment in February on medical advice. It was subsequently announced that **Mr R. D. Thomas,** D.P.A., F.C.I.S., had been appointed to fill the vacancy, but for personal reasons Mr Thomas found himself unable to take up the appointment and he is continuing as secretary of the Board's No. 3 sub-area. Mr Gibson, who has been the Board's assistant establishments officer since 1949, has spent 36 years in the electricity supply industry. Before the nationalisation of the industry he was on the staff of the Liverpool Corporation Electricity Supply Department, and was engaged in administrative and personnel work for many years (*ESH, pages 135/138).

At present with the Heating Division of E. K. Cole Ltd., **Mr George Wibrow** is joining the HVE (Electric)/Thermoduct Ltd. group of Leeds, as southern area manager as from 1 June. After war service with the RAFVR he was employed as a senior estimator in the cables department of Siemens Electric Lamps and Supplies Ltd. He joined the heating division of E. K. Cole Ltd. in 1949 as an area engineer and was promoted to executive technical and general sales in 1953.

Mr R. S. Gilling, B.SC., A.M.I.E.E., A.M.I.W.M., has been appointed manager of Associated Electrical Industries' military and marine radar works, Leicester, a part of the Electronic Apparatus Division. He served an engineering and graduate apprenticeship with the BTH Co. and in 1934 became a design engineer at the Rugby works in the then Home Appliance and Industrial Heating Engineering Dept. During the war he transferred to the Electrical Measurements Section of the research laboratory and, in 1946, became a section leader of the Electronic Engineering Dept. Since 1955 he has been superintendent of the Blackbird Rd works.

Cmdr F. Holmes has been appointed a director of the Westrex Co. Ltd., a division of Litton Industries Inc., of the USA, with responsibility for sales.

On his retirement after 40 years' service, **Mr A. L. Dandy,** manager of the Heating Division of the General Electric Co. Ltd., was the recipient of a presentation from the staff. The presentation was made by **Mr D. L. Tabraham,** managing director, Lighting and Heating Group.

Mr C. R. Bates, A.M.I.E.E., A.M.BRIT.I.R.E., has been appointed a director, sales and service, of the Canadian Division of the Weltronic Co. and is operating from 60A Station Rd, Solihull, Warwickshire.

Further changes are announced by Marconi's Wireless Telegraph Co. **Mr F. S. Mockford** relinquishes his post as commercial manager in order to undertake special duties for the managing director. His successor as commercial manager is **Mr F. Wheeler,** and **Mr H. Baker** becomes deputy commercial manager. Mr Mockford joined Marconi's as an engineer in 1930 and subsequently held a number of posts including those of deputy general manager, personal assistant to the chairman and managing director, and sales and contracts manager. He was appointed commercial manager in 1947. Mr Wheeler was sales and con-

Mr W. A. Gibson

Mr G. Wibrow

Mr R. S. Gilling

tracts manager, Marconi's Aeronautical Division, until his appointment as deputy manager of the division in January this year. Mr Baker has served the company abroad for many years, latterly as managing director of the Marconi Company in South Africa.

Sir Ronald L. Prain, chairman of the Rhodesian Selection Trust Group of companies, has been appointed chairman of the Commonwealth Council of Mining and Metallurgical Institutions. He succeeds Lord Baillieu.

Newly elected chairman of the Electric Vehicle Association of Great Britain is **Mr H. J. Gibson,** B.SC., A.C.G.I., M.I.E.E. **Sir Wavell Wakefield** has been re-elected president, as we noted last week, and **Mr A. H. Shaw,** M.B.E., of the Young Accumulator Co., as vice-chairman; with **Mr H. E. M. Bull,** of SEV (Sales and Service) Ltd., again as hon. treasurer.

To commemorate her year of office as chairman of the London Section of the Society of Glass Technology, **Dr Lucy Oldfield,** B.SC., PH.D., of the Hirst Research Centre of the General Electric Co. Ltd., has been presented with a glass slipper. Dr Oldfield has specialised in the development of glasses, especially for discharge lamps and glass-to-metal seals.

Chief development engineer with Turriff Construction Ltd. for the past 2½ years, **Mr E. W. Herrington,** M.I.MECH.E., M.I.H.V.E., has joined E. G. Irwin and Partners Ltd. as engineer in charge of the Mechanical and Electrical Service Department of the Industrial Division. Earlier, Mr Herrington was in the Engineering Division of the Ministry of Works for over 30 years, latterly in charge of the combined new works engineering drawing offices.

The Caroline Haslett Memorial Trust has awarded a scholarship at Cambridge University to **Miss Cynthia Shepherd,** of Chislehurst, who will read for the Natural Sciences Tripos at New Hall, and will specialise on physics with a view to making her career in electrical engineering. Miss Shepherd has recently been gaining experience as a temporary scientific assistant at the NPL at Teddington. The scholarship is worth £450 a year for three years.

Sir John Cockcroft has been appointed the new Chancellor of the Australian National University. This will not interfere with his present position of Master of the Churchill College, Cambridge, we understand.

Deputy Regional director, South Eastern Region, and controller of the Eastern Division, CEGB, **Mr W. N. C. Clinch,** O.B.E., M.I.E.E., F.INST.F., has retired. (*ESH, page 54.) He had been controller of the Eastern Division since its formation in 1948, after being general manager of the Northmet Power Co. for five years, and borough electrical engineer of the Brighton Corporation electricity undertaking from 1930 to 1943. He started with the Northmet Co. in October, 1911, holding various posts, including chief assistant engineer at Willesden power station from 1918 to 1921, then resident engineer at Brimsdown till December, 1926, and superintendent of power stations to the company from 1927 to 1930. He was awarded the O.B.E. in January last.

Managing director of Babcock and Wilcox Ltd., **Mr H. McNeill** has been elected chairman of the Water-Tube Boilermakers' Association in succession to **Mr J. B. Woodeson,** O.B.E., chairman of Clarke, Chapman and Co., who has completed a period of four years as the Association chairman. **Mr C. J. Howard,** managing director of John Thompson Water-Tube Boilers Ltd. has been reappointed vice-chairman of the Association, a position he has held since September, 1960.

OBITUARY

Mr W. A. Shaw, ASSOCIATE I.E.E., a director of Evershed and Vignoles Ltd., has died, aged 65. He joined the company's test room staff in 1913 and was for several years engaged in development and experimental work on a wide range of instruments. He transferred to the commercial side in 1919 as a technical assistant, and in this sphere he had a wide experience in the application of the company's products. In April, 1949, he was appointed general sales manager in succession to Mr F. C. Knowles, whose chief assistant he had been for 30 years and, in November, 1953, was elected to the board of the company as sales director. Recently he was appointed company secretary.

Mr T. B. Doig, M.I.E.E., latterly with Powell Duffryn Technical Services Ltd., died on 4 May, aged 53. Earlier, he had been manager of the Export Machinery Dept. of Dodwell and Co. Ltd., following a period as engineer and buyer in Manchester for H. A. Roberts and Cia, SRL, of Buenos Aires. His early training was obtained with Metropolitan-Vickers Electrical Co. Ltd., after which he served with Marryat and Scott Ltd., as a sales engineer with Bruce Peebles and Co., Harland Engineering Co. Ltd. and with Lancashire Dynamo and Crypto Ltd.

Mr C. E. Rickard, O.B.E., F.R.S., M.I.MECH.E., M.I.E.E., formerly general manager of Marconi's Wireless Telegraph Co. Ltd., died on 11 May, aged 80. He joined the company in 1898 as electrical assistant to Marchese Marconi, and retired in 1949.

Mr M. D. Stonehouse, M.B.E., M.I.E.E., distribution liaison technical engineer to the Electricity Council, died on 15 May, aged 59. (*ESH, page 45.) A funeral service is to be held at South London Crematorium, Streatham Pk, on 19 May at 2 p.m. Prior to the formation of the Electricity Council Mr Stonehouse had held a similar position with the CEA and its predecessor, the BEA. Before 1948 he was technical adviser to Electric Developments and Securities Trust Ltd.

NEW LITERATURE

The Testing of Electrical Machines

by L. H. A. Carr, M.SC.TECH., M.I.E.E.

THIS book provides a useful reference for the testing of rotating machines, but with the emphasis on the theory rather than the practice of testing. After considering general aspects of testing, tests on d.c. machines are considered, although it is a little surprising that in this section, there is no reference to instability. The theory of the induction motor and operational theory of the synchronous motor are covered in two chapters and two further chapters are devoted to synchronous machine tests and the synchronous induction motor. Other chapters deal with sudden short-circuit of an a.c. generator, turbo-generators and synchronous condensers. Testing in the factory and balancing techniques are also described. While the book contains a wealth of information, it is not particularly easy to read and could have been reduced in length and made clearer by better editing. Published by Macdonald, 299 pages, 8½ in. by 5½ in. Price 50s.

Magnetism and Electromagnetism

ed. by A. Schure

AMERICAN authors are producing many textbooks these days directed to the technician who is attempting to back up his practical experience with theoretical knowledge. The present volume comprises two books on the same subject, at different levels of complexity. In essence, it adopts a physicist's approach with a brief note on technical applications of the principles it discusses. Although the mathematics demanded of the reader does not extend beyond trigonometry, a useful amount of computation of magnetic forces in practical problems is made possible. Published by Chapman and Hall, 97 pages, 8¼ in. by 5¼ in. Price 37s 6d.

BOOK RECEIVED

The J. and P. Transformer Book, by S. Austen Stigant, H. Morgan Lacey and A. C. Franklin. Comprehensive text of all aspects of transformer design, manufacture, testing and operation. Published by Johnson and Phillips Ltd., 892 pages, 8¼ in. by 5¼ in. Ninth edition. Price 70s.

Double Insulation for Industrial Portable Tools

FACTORIES ACT REGULATIONS HAMPER APPLICATION

PORTABLE electric tools lead a rough life in the industrial world and sometimes get less maintenance attention than their manufacturers would wish. When this is the case, the earthing arrangements are particularly likely to suffer; and bad earthing can mean a shock accident quicker than most defects.

One answer to this problem which receives some official support is the use of low voltage. This has advantages and disadvantages, some of which are discussed later. There is another approach, with which this article is concerned, which perforce receives no official support at all in its pure form. That is the use of double-insulated construction.

Double Insulation

Before discussing the arguments for and against double insulation in industrial equipment, it is as well to look with some care at the concepts behind this technique, for although the term has become familiar in the electrical domestic equipment world, an air of mystery seems to attach to it so far as many engineers are concerned.

Double-insulated equipment protects the user against shock by interposing two distinct layers of insulation between exposed metal parts of the equipment and current-carrying metal. The idea behind this arrangement is that a defect is far less likely to extend from charged metal through two insulating barriers having different mechanical and electrical properties, than it is to pass through one homogeneous layer.

BSI has given recognition to double-insulation for some years now and there is a memorandum (BS 2754) which covers the essentials of the double insulation idea, as a guide to its incorporation in British Standards for particular appliances. This memorandum distinguishes the two layers of insulation already discussed as *functional insulation*, which is next to the live components in the appliance; and *protective insulation*, which is the insulation provided externally to the functional insulation, to ensure protection against electric shock if the functional insulation should fail. Since these terms are established, they will be used in the rest of the present article.

Statutory Difficulties

It is possible to make tools that comply with the recommendations for double insulation. Many are on the market and a revision of BS 2769:Portable Electric Tools (Hand-held), now being prepared, is likely to make provision for tests on such tools. But when they are intended for use in premises subject to the British Factories Acts, such tools must be supplied and used with an earth connection to exposed metal.

The reason for this is to be found in the Electricity (Factories Act) Special Regulations, 1908 and 1944, to which HM Electrical Inspectors of Factories have to work. Regulation 13 states:

> In all cases where the person handling portable apparatus or pendant lamps with switches, for alternating current or pressures above 150 volts direct current, would be liable to get a shock through a conducting floor or conducting work or otherwise, if the metal work of the portable apparatus became charged, the metal work must be efficiently earthed . . .

Thus, while all-insulated equipment, with no external metal parts, would be acceptable under the Regulations if it were practical, double-insulated equipment which uses an unearthed metal body for structural strength is unacceptable.

It is to be noted in this respect that the position on the Continent is rather different. There, the pressure for use of double-insulated construction is considerable, and the technique is mandatory in some countries.

Design Details

As an example of one manufacturer's approach to the problem of designing a double-insulated heavy industrial portable tool, we recently examined the heavy duty angle grinder produced by Wolf Electric Tools Ltd. This is a relatively new product.

The tool is cased in aluminium alloy, which is lined inside with glass fibre reinforced mouldings. These in essence provide the main protective insulation. The motor coils are encased in a moulded insulating shell, which fulfils a similar purpose. Functional insulation is provided by the usual insulation inherent in portable tool construction; slot liners, winding wire coverings, switch wire sleeving, switch insulation and the like.

Exposed metal shafts present a problem in this respect, and one that is clearly fundamental with tools such as drills, where the drill chuck and tool are of conducting metal. The solution adopted by Wolf is to sheath the armature spindle with a sleeve of insulating material as the protective insulation, before the core stampings are pressed on.

Cord entries into portable tools are a point of potential weakness whatever insulation scheme is adopted. The draft for the revision of BS 2754, recently published, makes special provision for this. It refuses to recognise the sheathing of twin cores and the like as protective insulation additional to the functional insulation provided by the core dielectric. If the case of the double-insulated appliance is of metal, the cord has to enter through a "properly secured insulating bush." Fig. 2 shows how this is managed with the Wolf grinder. The cord goes on to a switch cavity provided with nylon-moulded shields, as an extra precaution against troubles being caused by wires coming loose. The safety philosophy is extended by providing double-pole switching operated by an insulated trigger.

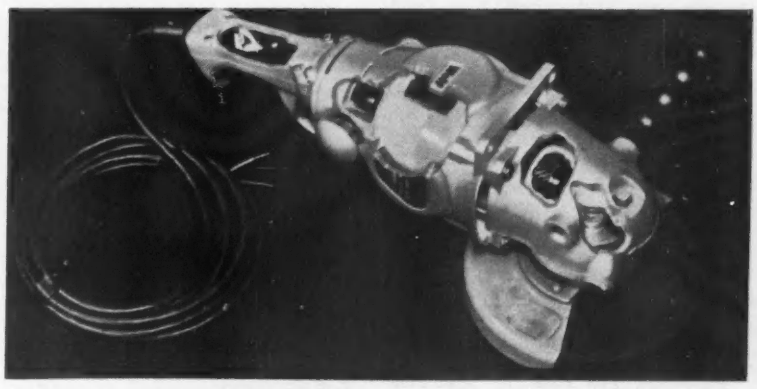


Fig. 1. A heavy duty grinder sectioned to show features of double-insulated construction which includes glass fibre moulded lining of the metal casing (Wolf Electric Tools)

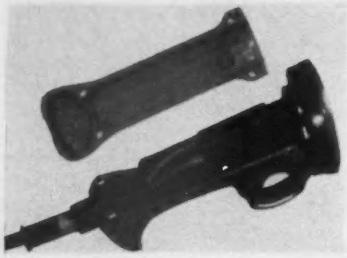


Fig. 2. Details of cord entry and switch in grinder shown in Fig. 1. The switch cavity is provided with moulded-nylon shields as an extra precaution against wires becoming loose

Safety Considerations

Double insulation has to be considered as one of three possible precautions against electric shock accidents; earthing and conversion to voltages of 55 V to earth and below are the others.

Earthing is simple in principle, but depends for its effectiveness on a sufficiently low impedance circuit being provided to the general mass of the earth; and on the earth connection to the tool being kept in good condition. Unfortunately, flexible connections are vulnerable, as already suggested, and tools work perfectly well in the absence of an earth connection. In consequence, it is only through constant maintenance effort and a regular earth-connection testing programme insisted on by management that a good degree of safety can be maintained.

Provision for earthing can introduce its own hazards. The last report of HM Electrical Inspector of Factories noted a case where an earth wire broke inside equipment, and made contact with a live wire, so that the frame of the equipment became live.

Low voltage as a precaution is pretty well foolproof so long as proper attention is given to the local transformers used to step down the voltage. These must be designed to have a high degree of security against faults from primary to secondary, for the safety feature is only as good as this. There is the consideration as well that tools wound for voltages of 55 V to earth and below usually cost more, weigh more, and (because of voltage drop at the heavier currents) have a more restricted working distance from the supply point than have those designed for normal mains voltage.

Double-insulated tools answer most of the criticisms of other methods, if they are properly designed and tested.

The main precautions to be taken are to design with ample creepage and clearance margins, and make use of labyrinth type openings where these are necessary because complete enclosure cannot be obtained for some reason. It is one of the main cares of specifications for double-insulated construction to lay down minimum leakage distances.

Functional and protective insulation must, of course, be independently capable of withstanding mains voltage with a factor of safety. The recommendation of BSI is for 4,000 V between conductors and exposed surfaces and for 2,500 V between the functional insulation and exposed metal parts. These voltages apply to equipment designed for operation at 250 V to earth.

Factory Use

The present position about double insulation is that, under the Factory Regulations, double-insulated construction of portable electric tools must be accompanied by an earth connection to any exposed metal work. This will remain in force until amending legislation is introduced. While it remains, the questionably necessary, and possibly dangerous practice of adding an earth connection has to be followed.

Section 4 of the Regulations for the Electrical Equipment of Buildings (thirteenth edition) issued by the Institution of Electrical Engineers accepts double insulation, provided it conforms with a British Standard which has been recognised for the purpose of the IEE regulations.

We are indebted to Mr C. H. Gubbins, chief designer of Wolf Electric Tools Ltd., for discussion of the principles and problems of double insulation design in this field.

SWITCHBOARD CLEARANCES

FROM time to time, the Electrical Inspectors of Factories complain that engineers are neglecting the regulations under the Factories Acts which lay down minimum clearances for switchboards. There are five regulations in the Electricity (Factories Act) Special Regulations, 1908 and 1944, which apply. One of them, Reg. 17, goes into considerable dimensional detail, the essentials of which are shown in Fig. 1 below.

Control Boards as well

The dimensions shown apply whenever there are bare conductors in a switchboard, unless these conductors are otherwise screened. One of the details to watch in this regulation is that it applies not only to conductors bare in normal operation, but also to those "arranged to be exposed when live." This has been interpreted as including conductors normally enclosed in a cabinet, the doors of which have to be opened when the switchgear concerned is operated. "Switchboard" may be misleading, too; the official definition is worded so that a control panel is included, together with any similar collection of equipment. Thus, contactor panels for industrial plant come fully within the clearance requirements stated.

A point that is noted on the sketch is that floors near switchboards are required to be "firm and even." This is written into the regulations, and it is a requirement that extends to the placing of insulating mats, or ramps over cables which may cross the passageway in front of the switchboard. Anything in the nature of loose planks is forbidden.

The width specified in the regulations are measured from the live conductors, and they are required to be "clear." The point has been made that this implies that screens or circuit-breaker frames or operating mechanisms must not be allowed to project into the passageway, otherwise the actual width measured from the conductors may have to be increased to provide the "clear" minimum.

When control boards are arranged with equipment at voltages of 50 V or 110 V, as is increasingly the case, the dimensional requirements do not apply; nor do they in public supply generating stations where the voltage to earth is 250 or less. However, taking advantage of this exemption for generating stations has been deprecated. Adequate clearance is desirable in all cases.

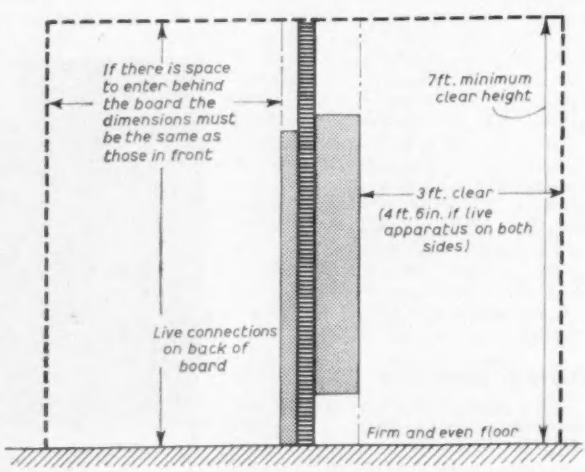

If there is space to enter behind the board the dimensions must be the same as those in front
7ft. minimum clear height
3ft. clear
(4ft. 6in. if live apparatus on both sides)
Live connections on back of board
Firm and even floor

Fig. 1. Minimum clearances required for switchboards and control boards where live conductors may be exposed. These dimensions apply to medium-voltage boards

How right are your brushes?

FACTORS AFFECTING LIFE AND EFFICIENCY OF CARBON BRUSHES

NOWADAYS few maintenance engineers in charge of electrical equipment are unaware of the importance of using the proper grade of carbon brush in electric motors and generators; most have some idea of the importance of brush spring adjustment. As to what constitutes correct grade and pressure, they are mainly dependent on the recommendations of the manufacturer and the reasons for the choice are largely a "closed book." Moreover, the methods of checking the brush contact pressure are often left to the imagination of the engineer with results which, to say the least of it, are liable to be inconsistent and not necessarily those intended.

Morganite Carbon Ltd. who can speak with much authority on carbon brush design and performance, have just issue the second of a new series on "Carbon and Its Uses,"* in which the veil is partly lifted for those who have electrical equipment in their care.

Choice of Grade

There are, of course, many grades of carbon, with or without metal or graphite content, used for sliding contacts but the general purpose material most widely applied to commutator and slip-ring brush production is a refractory carbon base incorporating sintered metal. Such grades are mechanically robust and weld-resistant and, more usually, the metal is electrolytic copper for use with copper commutators and slip-rings. It is a general rule that the best efficiency of contact is achieved where the metal content of the brush matches that with which it is in contact.

This grade, in the Morganite range, is accorded Group Identification DM and is suitable for most applications involving medium current ratings not exceeding about 120 A. The life and performance of the brush in service is a function of the heat generated mainly as contact resistance at the interface. This, in turn, is dependent on contact pressure and Fig. 3 shows how contact resistance and pressure are inter-related with a typical Group DM brush.

Brush Shape

Apart from the very smallest of motors, the usual section adopted for brushes is rectangular with the main axis either vertical to the commutator tangent (radial), sloping towards (reaction) or away from (trailing) the direction of rotation. The shape of the contacting face is, of course, concave to mate with the commutator or slip-ring, but for practical purposes may be considered as a straight line, while the opposite end, mating with the spring or spring-arm in the holder, may be squared-off or bevelled at an angle to the axis.

In the axial design, the pressure of the spring on the end of a squared-off brush is applied directly to the brush/commutator interface and its measurement, by spring balance, to determine the pull-off load is quite straightforward. But this is certainly not the case in any other configuration. How, then, must we apply a pull-off test in any of the other configurations to get a true measure of brush/commutator contact pressure and how may it change with brush wear?

In an attempt to answer these questions, an investigation was carried out which fell into two broad parts; a theoretical examination of the problem from first principles and tests to confirm or dispute the theoretical findings.

First Principles

In the first part the forces acting on a brush in a brush holder were analysed and expressed vectorially in force diagrams for different forms and attitudes of brush. The forces on the brush surface are three in number: a force normal to the brush top resulting from the action of the pressure finger or spring; a force normal to the contact surface reacting from the commutator; and a force normal to the brush box face which is the reaction to sideways displacement of the brush within the box.

In the case of a bevelled-top brush the force normal to the spring or finger contacting surface will be different from that applied along the axis of the brush on the commutator and, when the spring lever is pivoted around a point at the side of the brush-box, will vary with brush wear, since the angle of application of pressure will change.

These calculations were made for typical cases and the results tabulated, first as a force required to produce unit axial compressive force in the brush and second as a force required to produce a 2 lb load in three directions: at right-angles to the lever, parallel to, and normal to the brush top, with different degrees of wear.

Laboratory Tests

The second step was to examine, by practical experiment, the relation between the theoretical aspect and practice. Here the most significant results were obtained from tests of radial cantilever brushes with a top bevel of 40°. The tests were carried out on a 10 in. dia commutator at a peripheral speed of 5,000 ft/min with a current density of 55 A/sq in. (Fig. 1.) The results showed that the effective pressure in the 40° bevel top brush was less than half of that obtained with the flat-top brush, a difference rather greater than that suggested by the theory. In other cases, the tests substantiated theoretical values. A method of testing spring pressure with a balance applied to the pressure finger is described using a thin paper feeler as a gauge to determine the actual point at which load is released from the brush (Fig. 2) with a 10% additional allowance if the top bevel exceeds 25°.

*"Carbon and Its Uses," Issue No. 2. Morganite Carbon Ltd., Battersea, S.W.11.

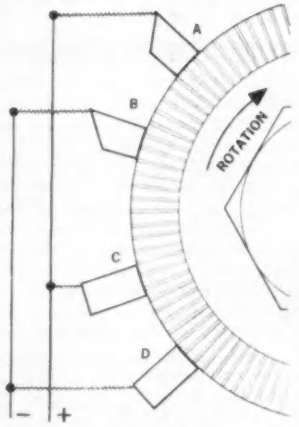


Fig. 1. Rig for checking theoretical values

Fig. 2. The pull-off test

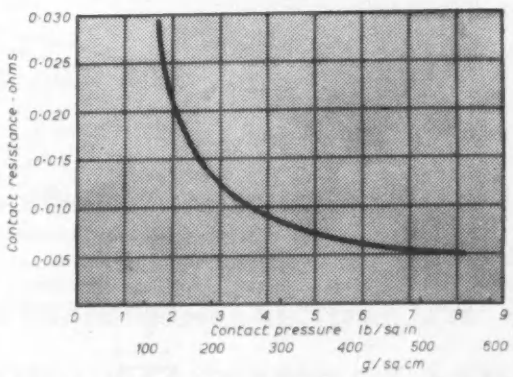


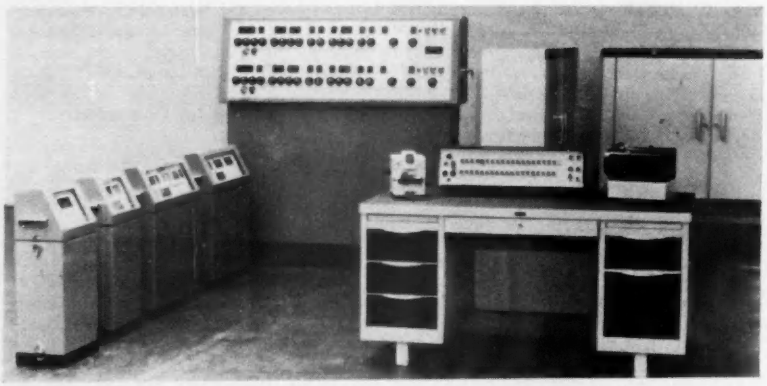
Fig. 3. Graph showing relation between contact resistance and brush pressure. Grade DM.5A.

Computers for Line-control

APPLICATIONS OF DIGITAL COMPUTERS IN THE STEEL INDUSTRY

THE faith of the mathematician in the possibilities of the electronic computer is infinite. So is his enthusiasm. But the hard-headed industrialist requires more than just second-hand, blind faith and enthusiasm; he must be able to see some tangible results from its application to his own problems, which will increase the productivity of his works and employees and give him a shade better chance in competing with his opposite numbers at home and abroad.

There is no more competitive industry than that concerned with the production of iron and steel; nor one better noted for the hard-headed judgment of its managements. The fact that, of 12 papers discussed at the annual general meeting of the Iron and Steel Institute earlier this month, ten were concerned with the use of computers for research, process and production control is a sure sign that the industry has accepted them as an essential part of the modern works organisation.



The Elliott computer control centre at Samuel Fox and Co., Stocksbridge

Computers in the Steel Industry

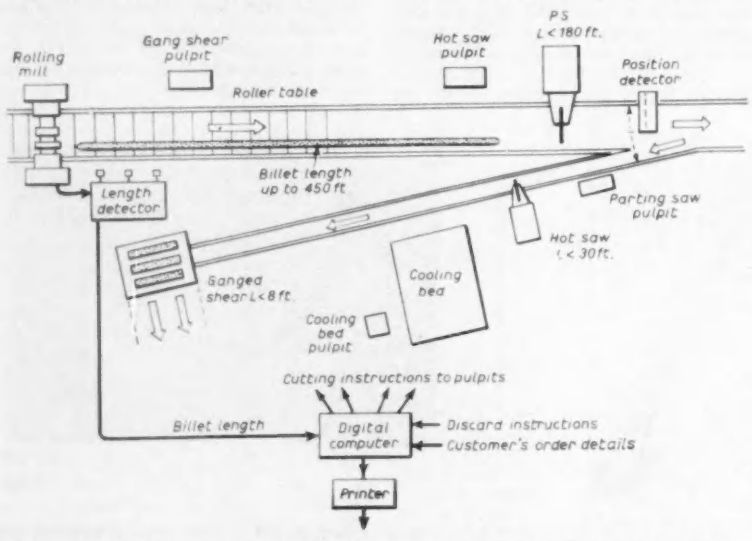
In a survey of the uses of computers in the industry,* Owen and Taylor disclosed that, by January of the present year, seven digital computers had been installed, three orders had been placed and other companies were actively considering the uses of such devices in their own works.

The first to purchase an installation was Tube Investments who have used their IBM 650 since July, 1957, mainly on commercial work, but occasionally for scientific calculations. The commercial use includes the preparation of routine schedules for final stages of tube production. The purchase of a Ferranti Pegasus I by BISRA in November, 1957, followed promising use of the similar machine at Manchester University. This has been in constant use by the Association and its members, mainly on statistical analyses and operational research calculations, to the present day.

In 1958, two other companies, United Steel and Stewarts and Lloyds, followed suit, the former installing a Pegasus I for their use, jointly with the Sheffield University, on operational research and pilot production jobs. The LEO II, installed by the latter at Corby, is used mainly on payroll, warehouse invoicing and stock control routines which occupy a five-day week with late working on two days.

In 1960, United Steel installed an ICT 1202 at head office to build up experience in accounting and related applications. It has since been extended to payroll, stock control and programming of diesel locomotive production. In the same year, following use of the BISRA machine, the Steel Co. of Wales installed a Pegasus I, mainly for research and development uses, but with restricted commercial applications.

* "Survey of Technical and Scientific Uses of Computers in the Iron and Steel Industry," D. G. Owen and R. J. Taylor.



Layout of the Elliott computer-controlled billet cut-up line at the Works of Samuel Fox and Co.

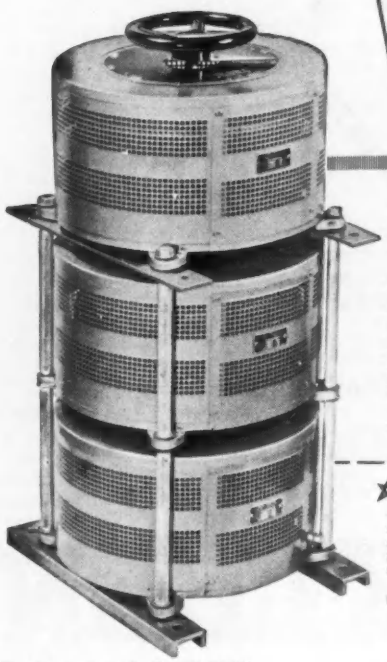
Computer Line Control

To this stage, the main use of computers has been for the purely mathematical determination of formulae, schedules, etc., to assist scientists engaged on development work, accountants and progress departments. That they have proved themselves is shown by the extension of these facilities at the Steel Co. of Wales and Tube Investments—who have ordered further computers—and the placing of an order for an IBM 305 "Ramac" computer by Dorman Long.

A major breakthrough for the appliances has been in the acquisition of an Elliott 803 general-purpose computer in association with a Panellit 609 information system by Samuel Fox and Co. for the direct control of cutting operations on billets as they emerge from the mill, so as to avoid undue wastage.

The billets are rolled in lengths of up to 450 ft and travel on the roller table while still hot, to be cut at two or more hot saw positions and a final shear position in lengths to suit the customer's requirements. The mill foreman knows the sizes required, but is rarely aware of the final size of the billet as it emerges from the rolls. His problem is to determine the number of lengths to various requirements he can cut from each with minimum waste.

To do this he has to measure the length of the billet, determine the best cutting points, advise the saw operators —of whom there are several—and, finally, record the data for office purposes. He must do it without holding up the flow of billets on the track no mean task



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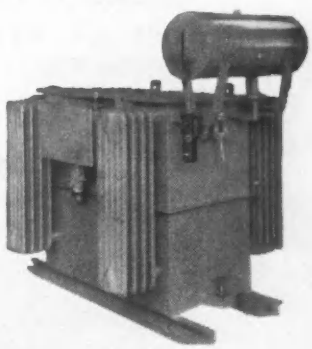

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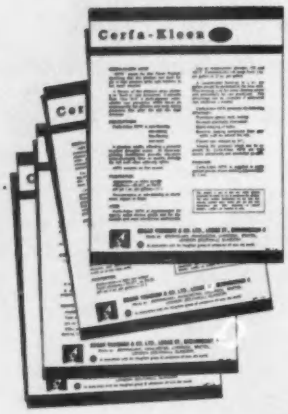

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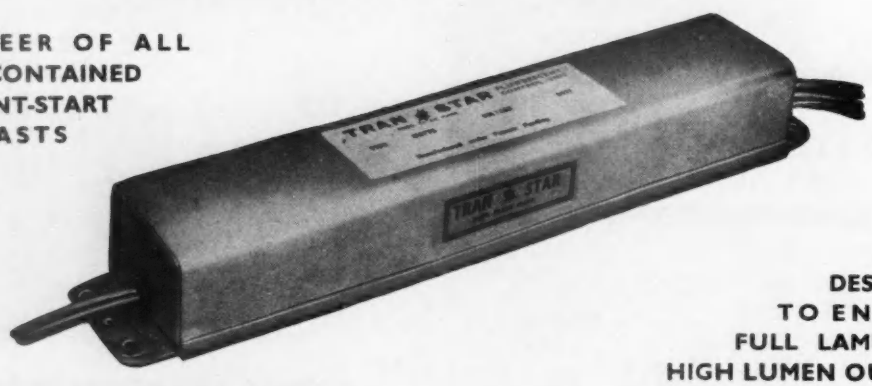

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if any degree of accuracy is to be attained.

The computer is far better placed to make the calculations, providing only that the information on initial length can be supplied automatically as the billet leaves the mill. E-A Automation Systems Ltd., a member of the Elliott-Automation Group specially organised to deal with such applicational problems, worked in conjunction with Samuel Fox and Co. and succeeded in evolving a system which is giving rapid and accurate information to the operators on the saw and shear pulpits at the cutting positions. The display pulpits are on the left of the photograph on page 798, but in practice, of course, they are located by the operators' positions as shown in the layout diagram.

Billet Length Detection

Length detection is by a self-calibrating, pulse-counting system employing lead sulphide detectors with the correct response to detect billets at temperatures over 400°C. This information is fed direct to the computer, enclosed in the cabinets at the back of the photograph. The panel to the top left centre is used to set up the customer's order and is operated by the mill foreman who therefore maintains personal responsibility. The control console is in the foreground together with the printing apparatus which keeps the records.

The computer measures the length of the billet and calculates the economic cutting points to satisfy the customer's requirements without waste — making allowances for variability of the stops, shears and saws as well as for the required test pieces—presenting the result on the pulpit displays, within one second of the billet leaving the mill.

Each operator, by pressing a demand button, receives the necessary stop setting information and a back check ensures that the billet he is cutting corresponds to the one displayed on the panel. Other checks detect and warn the foreman of any abnormalities in the system. A data storage system retains the information until called for by the operators. Since commencing operations in February this year, several minor adjustments and improvements have been effected and already there is evidence that the savings, if not fully substantiated, will be close to those expected. Though the cutting operations are still manually controlled, steps are being taken to extend the system to fully automatic operation as soon as the necessary experience has been obtained.

Analogue or Digital?

In the system so described the basic computer is a digital one, as are all of those which have received previous mention. The question may be asked—and, indeed, has been asked—"Since this is a special application, would not an analogue computer have been more satisfactory and economic?" The answer is that, for a specific application there is a crossover point where the economics of digital and analogue computers interchange. In the present case the digital type was found to be more economic to apply, but in a more extensive application the analogue type might come into its own. Even in the more restricted field of works programming, as Cartwright and Thomas have said,† analogue computers could be used in programming stock movements, etc. Such an analogue has not yet been realised in practice.

If such a machine could be designed, it would need to develop through various phases, from its likely immediate use to some unknown future when the machine "advises" the management. Though the analogue probably operates at higher speeds and is sufficiently accurate, it lacks the adaptability of the digital computer.

Problems of Introduction

The main problem of introducing a computer into an organisation is the understanding of the formal language, rigid, precise and detailed, by which the information is fed to the machine, a language which may vary from one machine to another.

This necessitates a frame of mind not easy to acquire by one long trained in other methods. Some training is needed and the supply of recruits from universities and technical colleges cannot be sufficient. Nor is the trained and experienced engineer satisfied to leave the operation to a junior, graduate or not, unless he also understands the operation of the machine.

This is the problem of the computer manufacturers. They will have to make the programming easier and more formalised as they develop their later and better machines and they must be able to show mature engineers how to use and apply them, not merely the principles on which they work. Each year about 100 new computers come into service, only a small proportion of which are directly associated with production. There are already signs that they can be applied successfully to production control—an example is the monitored broadcast from Russia last December reporting the control of a Bessemer shop by a computer 300 miles away—and the idea that they are useful solely for accountancy or the solution of abstruse equations is no longer tenable.

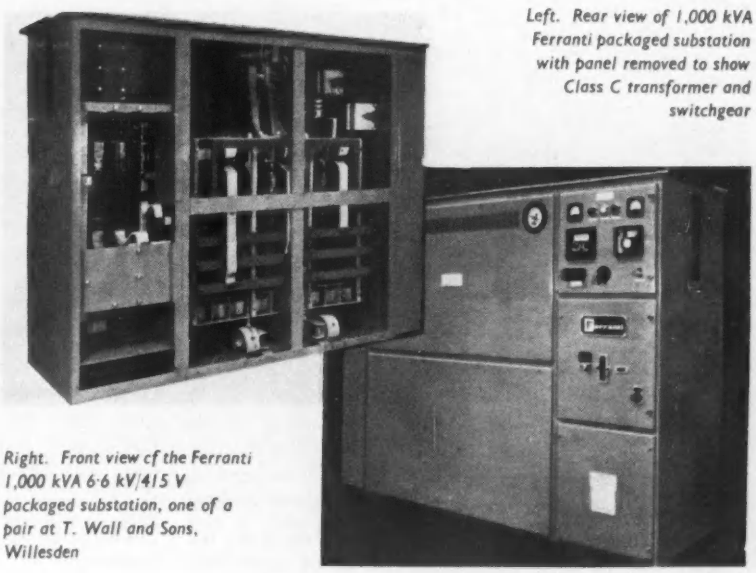
† "Integration of Production Planning, Data Processing and Process Control," W. F. Cartwright and G. W. Thomas.

Packaged Substation Developments

THE entry of Ferranti Ltd. into the packaged transformer substation field is signalised by the installation, at the Willesden cold-storage plant of T. Wall and Sons Ltd., of two 1,000 kVA 6·6 kV/415 V units of the totally enclosed type incorporating Class "C" air-cooled transformers.

The transformers are direct-coupled, through off-load isolators, to a Morecambe Electrical Equipment Co. switchboard of the multi-contactor pattern for the control of ammonia compressor motors totalling approximately 2,000 b.h.p. The transformers and isolators in their enclosure are installed at each end of the multi-starter switchboard on a gallery overlooking the compressor hall. High voltage switchgear controlling the incoming 6·6 kV feeders is located in the existing substation with remote closing and tripping from the transformer panel. Restricted earth-fault protection of the transformer m.v. windings is also provided.

The transformers are mounted on rollers to facilitate removal from the enclosure for maintenance. Cooling air is ducted from outside through a filter. The scheme was designed by the technical division of Unilever Ltd. in conjunction with Ferranti Ltd.



Left. Rear view of 1,000 kVA Ferranti packaged substation with panel removed to show Class C transformer and switchgear

Right. Front view of the Ferranti 1,000 kVA 6·6 kV/415 V packaged substation, one of a pair at T. Wall and Sons, Willesden

The Engineer and the Planner

IN modern industry, the work of the planner and the engineer are complementary. The former may be more concerned with the flow of work through an industrial unit and the latter with the technical problems of the machines, but both have their part to play in more efficient production. Any slight disharmony between them will only increase the problems of both.

In a paper read before the ASME at Toronto recently, Mr D. Nicholson, managing director of Production Engineering Ltd., the management consultants, commented on the current trends of design and planning for factories in different countries. There is a constant interchange of methods and ideas brought about, not only by the exchanges of views and experiences at symposiums and meetings of engineers, but also by the setting up of subsidiaries in other countries, taking with them the processes and practices from the parent firm. In recent years more than 700 American and 500 British offshoots have been set up outside these two countries with, of course, similar offshoots here and in the USA from European countries.

The function of the management consultant is to examine the existing production equipment and layout in relation to the product and to advise on how both space and plant can be used more productively.

This involves long and careful studies of time and effort spent by different operatives, machines, cranes, transport, etc., on a particular product. Since most companies manufacture a range of products, each in different demand, the more complex study is the interproduction of these with efficient use of equipment and manpower. Some of this study will eventually be done by computers.

It is the function of the engineer to keep up to date with the latest developments in machines and tools, both from home and overseas sources, and to advise the planner how these may be integrated into the programme. Many of the latest tools are computer-controlled and this, in itself, introduces changes in conventional machine tool design.

Shop floor transport of large items is usually by crane. Where craneage is inadequate, the solution may be by the greater use of floor or local cranes rather than by doubling up overhead types.

In regard to manpower, loss of time through sickness, fatigue and associated causes can be traced back, in many cases, to inadequate ventilation, poor lighting and noise, a sphere of activity in which the engineer is much more at home than the planner.

LIGHTING IN INDUSTRY

THE 1961 edition of the IES Code for lighting introduces new, improved standards for all industrial and commercial locations. It also gives more detailed recommendations for minimum illumination on the working plane and, in many cases, a "Glare Index," the limiting value for glare when assessed according to the method described in the code. The relevant figures for most industrial locations are tabled below for the assistance of works and maintenance engineers. The IES Code can be obtained from the Illuminating Engineering Society, 32 Victoria St, London S.W.1. Price 12s 6d.

		lumens/ sq ft	Glare Index
GENERAL FACTORY AREAS	Canteens	15	
	Cloakrooms	10	
OUTDOOR FACTORY AREAS	Entrances, corridors, stairs	10	
	Stockyards, main entrance and exit roads, car parks	2	
	Internal factory roads	*	
ASSEMBLY SHOPS	Rough work	15	28
	Medium work	30	25
	Fine work	70	22
	Very fine work	150	19
BOILER HOUSES	Coal and ash handling	10	
	Boiler fronts, operating areas	10	
	Other areas	2-5	
	Outdoor catwalks	2	
	Outdoor platforms	5	
COLLIERIES	Surface working areas	15	
	Surface other areas	10	
	Picking belts	30	
	Winding houses	15	
	Main lamp room areas	10	
	Lamp room repair sections	15	
	Weigh cabins	15	
	Fan houses	10	
GENERATING STATIONS INDOOR LOCATIONS	Turbine halls	20	25
	Battery rooms, blowers, auxiliary generators, switchgear and transformer chambers	10	
	Boiler houses, platforms, coal conveyors, pulverisers, feeders, precipitators, soot blowers	7-10	
	Boiler and turbine basements	10	
	Conveyor houses	7	
	Conveyor gantries and towers	7-10	
	Vertical control panels	20-30	19
	Control desks	30	19
	Rear of control panels	15	19
	Switch houses	15	25
	Reactor areas, boilers	15	25
	Gas circulator bays	15	25
	Reactor charge/discharge area	20	25
GENERATING STATIONS OUTDOOR LOCATIONS	Coal unloading areas	½	
	Coal storage areas	0-1	
	Conveyors	1	
	Fuel oil headers	5	
	Oil storage tanks	1	
	Catwalks	2	
	Platforms, boiler and turbine decks	5	
	Transformers and switchgear	2	

		lumens/ sq ft	Glare Index
FORGES	General	15	28
FOUNDRIES	Charging floors, pouring, fettling, rough moulding and core making	15	28
	Fine moulding and core making	30	25
GAUGE, TOOLROOMS	General	70	19
INSPECTION SHOPS	Rough work	15	28
	Medium work	30	25
	Fine work	70	22
	Very fine work	150	19
	Minute and small instrument	300	10
IRON AND STEEL WORKS	Marshalling and stockyards	1-2	
	Stairs, gangways, basements, quarries, loading docks	10	
	Slab yards, melting shops, furnace working areas, plant and pump houses	10	28
	Mould preparation, rolling and wire mills, motor rooms, etc.	15	28
	Slab inspection, strip mills, sheet and plate finishing, tinning, galvanising, roll shops	20	28
	Plate inspection	30	
	Tinplate inspection	Special	
LABORATORIES, TEST ROOMS	General labs., balance rooms	30	19
	Electrical and instrument rooms	45	19
MACHINE SHOPS	Rough bench and machine	15	28
	Medium bench and machine	30	25
	Fine bench and machine	70	22
PAINT SHOPS AND SPRAY BOOTHS	Dipping, rough spraying	15	25
	Rubbing, painting, finishing	30	25
	Fine painting and spraying	45	25
	Retouching, matching	†70	19
PLATING SHOPS	Vats, baths, buffing, polishing	15	25
	Final buffing and polishing	Special	25
SHEET METAL WORKS	Benchwork, scribing, punching, shearing, spinning, folding	20	25
	Sheet inspection	Special	
WELDING AND SOLDERING	Gas and arc welding, spot welding	15	28
	Medium soldering, brazing	30	25
	Fine soldering and spot welding	70	22
	Very fine soldering and welding	150	19
WOODWORKING	Rough sawing, bench work	15	22
	Sizing, planing, rough sanding, machining, glueing, veneering	20	22
	Fine bench and machine, sanding, finishing	30	22

* Internal factory road lighting should conform to BS.CP1004.

† For colour matching the light colour quality is also important. Where "Special Lighting" is shown, the fitting has to present the light at the proper angle to the working surface. For fine work, calling for illuminations of 100 lm/sq ft and above, optical aids are usually necessary. On instrument panels and boiler gauge glasses, supplementary local lighting may be required.

Indian supply development

HYDRO LIKELY TO REMAIN MAIN POWER SOURCE

AS part of the programme for industrial development, India has recently embarked on the third five-year plan. If the plan goes according to schedule, by 1966 the generating capacity will have risen to 11,800 MW, or five times that at the beginning of the first plan in 1951. Over the same 15-year period the number of towns and villages with an electricity supply is scheduled to rise from 3,700 to 34,000.

In the annual lecture to the supply section of the IEE, Dr M. Datta, M.SC. TECH., PH.D., Chief Engineer, West Bengal State Electricity Board, surveyed progress under the two completed plans and outlined developments under the current third plan.

India has an area of 1,270,000 sq miles and a population exceeding 430 million, 70% of whom, even today, are engaged in a medieval system of agriculture. The majority of the population lives in villages of 250 to 5,000 and so far only the larger communities have been provided with electricity. With an annual energy consumption of $1{\cdot}2\times10^9$ MWh/year, of which $15{\cdot}1\times10^9$ MWh/year is electrical, India has one of the lowest electricity consumptions per person of any country in the world. The figure is 0·04 MWh/head, compared with 2 MWh in the UK and 4 MWh in the USA.

Generation Plans

Generation and distribution of electricity is the responsibility of the State electricity boards, whose programmes are co-ordinated by the Ministry of Irrigation and Power through the Central Water and Power Commission to determine priorities for the allocation of foreign exchange. At the beginning of the first five-year plan, the installed capacity was only 2,300 MW; 1,100 MW of new plant was installed during the first plan and a further 2,400 MW during the second plan, although the target for this plan was originally put at 3,500 MW. Further increase during the third plan period is scheduled at 6,000 MW, including 300 MW of nuclear generation. Emphasis under this current plan is on industrial development in the capital industries. However, despite this relatively large programme, there is some indication that the demand by 1966 will have risen to 14,000 MW instead of the 11,800 MW planned.

Water and Fuel Resources

Energy sources in India are plentiful, particularly the water-power potential. However, many of the hydro resources need extensive reservoirs to make use of the river conditions characterised by low flow in summer, rising to a heavy discharge during the monsoon months. Hydro schemes must also be planned with the overriding requirements of irrigation schemes in mind. Even so, the country's water-power potential has been estimated to be 40,000 MW at 60% load factor, or nearly 210 million kWh annually. Hydro resources are fairly evenly distributed over the country, and a similar potential exists in neighbouring countries which may be exploited in conjunction with India. One of the greatest potentials is in the U-bend of the Brahmaputra just before it enters India from Tibet. Over a distance of 125 miles the river falls 8,000 ft and has a minimum unregulated flow of 30,000 cusecs.

India's coal resources are estimated at 120,000 million tons and are localised in the four most eastern states. However, although the deposits are fairly extensive, the quality of coal is generally poor. Oil and natural gas resources, at present known, are limited and would probably be required for transport rather than power generation.

In the parts of the country remote from both hydro and coal reserves, India plans to construct nuclear stations. The country has reserves of natural uranium and it is also particularly rich in thorium. In consequence, India's nuclear programme is based on three stages. In the first, reactors will be fuelled by natural uranium producing plutonium as a by-product. In the second stage, the intention is to construct fast breeder reactors, while in the third stage reactors operating with thorium and plutonium as fuel are envisaged.

One of the factors influencing the choice of generation is the foreign exchange component of currency required. For a coal-fired station this is two or three times that for a hydro station, while for a nuclear station it is even more. Thus, it is likely that hydro power will predominate for many years to come, and with conventional power stations yielding supplementary power.

One aim of the five-year plan was to increase the use of electricity in agriculture. Nevertheless, the paper quoted figures for the year 1957-58, which showed that, of energy

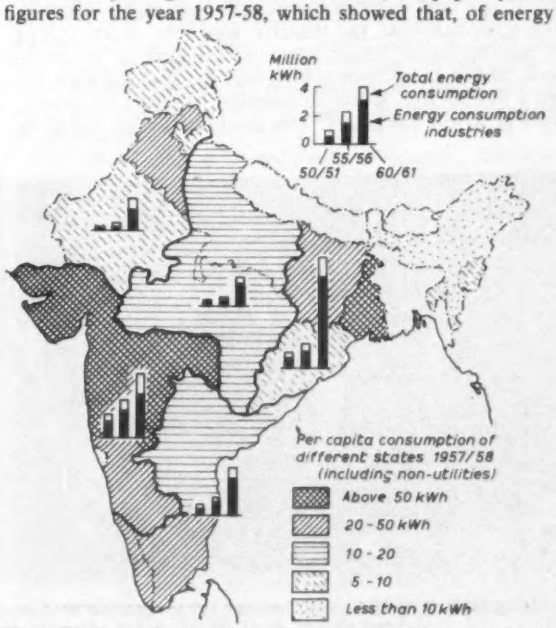


Fig. 1. Trends in electricity consumption in some of the zones of India

generated by public utilities, 54% was used in industry and only 15% in commercial and domestic installations. A further 18·5% was used and generated by industry. The traction requirement of 3·8% was likely to rise, since the second plan included an electrification programme for 826 miles of track operating on a 25 kV, a.c., 50 c/s system.

Referring to transmission and distribution equipment, Dr Datta commented on the extreme climatic conditions under which systems have to operate. In consequence ratings of equipment had to be reduced. India could now build all except the largest of the transmission towers required. Lightning was the most frequent cause of interruption and, although overhead earth lines were used for h.t. lines, their use was not favoured for sub-transmission lines at and below 33 kV. Unearthed and unbonded lines on wood poles provided the best performance under lightning conditions and also avoided risk of shock.

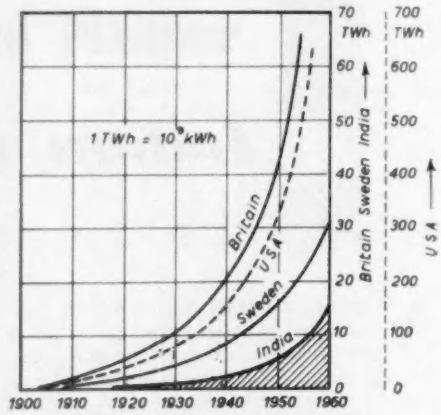


Fig. 2. Illustrating the growth of Indian consumption of electricity compared with the USA, Britain and Sweden

N.C.B. SEEKS PRICE STABILISATION

LONG-TERM fixed price contracts are the aim of the NCB, said the Board's chairman, Mr A. Robens, when he proposed the toast "Electrical Development" at the annual luncheon of the Electrical Development Association last week. Mr Robens spoke of the electricity industry as the NCB's biggest customer. Electricity was also the ally of the NCB, which was seeking more mechanisation, which meant electrical drives.

Mr Robens said he recognised that nuclear power and oil-burning were required in Britain's fuel programme and might be the right answer in some parts of the country. However, from many considerations, including those of strategical importance, the right policy was to use indigenous products, although it did not follow that the NCB should regard the electricity industry as "a captive customer."

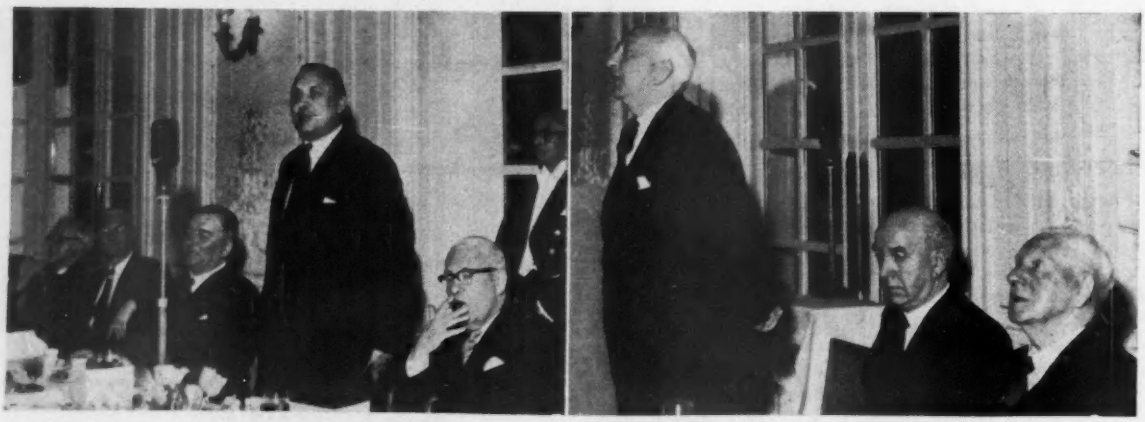
If electricity was to continue to offer its benefits to today's community, the task of the NCB was to maintain stability of prices. Mr Robens said he hoped to make long-term contracts with prices fixed, and even to bring down the price of coal. He would not hold out hope of doing this if the coal industry were today not highly efficient. The truth was that the industry was only on the fringe of making use of power and mechanisation in its operations. It had to be remembered that the coal industry was not a flexible one. It had to maintain its return on capital, none of which was equity. This meant that sales had to be kept at about the 200 million tons/year level. In 1961 the NCB hoped to bring into the pits more than twice the power-loading equipment that had ever been installed in one year before.

Mr Robens called electricity supply an ideal user of coal, because it did not mind the quantity of ash included so long as it remained constant. "Coal by wire" was about the best way possible to use coal in this country.

Fuel and power policy, said Mr Robens, could best be left to compromise agreement between the heads of nationalised industries.

The task of replying to the toast fell to Sir Edwin Herbert, president of EDA, who recalled the early days of the electricity industry, when he was concerned in law-suits on behalf of power companies. Electricity, he said, had revolutionised social habits of the country by releasing the housewife from her drudgery.

Competition between various fuels was the greatest incentive to efficiency of use of all fuels. Sir Edwin paid tribute to the "astonishing success" of the electricity authorities in developing thermal efficiency and also bringing down the cost of power stations. Despite such success, the electricity industry could not solve all its problems itself. Questions such as whether overhead lines shoud be undergrounded needed to be decided by broader considerations.



At the top table at the EDA annual luncheon, left to right: Dr W. R. Mathews (Dean of St. Pauls), Mr R. S. Edwards, Mr D. Irving, Mr A. Robens, Sir Edwin Herbert, Mr H. Wooley (N.F.U., proposing the toast of the guests), Sir Josiah Eccles, and Lord Citrine

Off-peak heating vindicated

H.V.R.A. REPORT SHOWS WHY IT SEEMS SO MUCH MORE ECONOMIC THAN HOT WATER AND OTHER METHODS

THERE have been many sharp debates between heating engineers experienced in conventional methods of heating buildings and electrical engineers advocating electrical off-peak heating. The differing standpoints are summarised in a report* of the Heating and Ventilating Research Association in words that can hardly be bettered:

> The design of electric floor- or block-heating installations has hitherto been largely on an empirical basis, leading to systems which, by conventional standards, were often undersized. Evidence has accumulated that generally the majority of these installations function satisfactorily, with an apparently low consumption of electricity.

The Association has been investigating this anomaly and seems to have resolved the apparent contradiction. The present report suggests that there are three factors broadly favourable to electrical methods. First, the thermal transmittance of building structures averaged over a season (on which fuel consumption depends) is less than the U-value taken for design purposes. Next, lower rates of air change are experienced than design methods normally allow, especially at night; and finally, the miscellaneous heat gains normally experienced in a building may amount to as much as 30% to 40% of the theoretical value of heat input required over a heating season.

Poor Boiler Efficiency

With reference to comparisons between electrical energy and the heat content of fuel used for firing boilers in conventional systems, it is suggested in the report that the seasonal efficiency of boilers can be less than the range 60% to 75% normally assumed. For solid fuel boilers, unpublished Building Research Station work indicates that the seasonal efficiency may fall as low as 45%.

Closer Design

The report contains many recommendations for more accurate designing of floor-warming systems. For example, the reduced ventilation postulated at night is underlined as "an important change from current design practice."

The design heat loss for a building is defined in the report as follows: from the sum of all losses to outside through unheated surfaces, plus the loss due to ventilation, any known heat gain, such as that from a heated floor above, is subtracted. Other gains, if known to be permanent and assured, should also be added. The total so found is the net heat requirement. Thus, in the case of a floor-warming installation, losses from the floor to the room below or the ground are excluded.

The design heat requirement is arrived at by adding to the net requirement the downward heat loss.

For off-peak floor-warming, the recommendation is that the temperature of the building should not fall by more than 6°F, and that the mean daytime temperature should approximate to the middle of the comfort zone. The report includes empirical formulae and tables to use in estimating the swing in temperature to be expected under design conditions.

Commencement of heating as late as possible during the night and maximum use of mid-day boost is recommended in the interests of economy. The limit placed on floor surface temperature (78°F normal maximum during hours of occupation) implies that the heat loss from a building heated to 65°F should not exceed about 35 B.Th.U./hr/sq ft of floor area.

Thermal Insulation

On the much-argued question of thermal insulation the report suggests that, when it is necessary to reduce interaction between storeys of a building, there is advantage in insulating individual floors by 1 in. or 2 in. of expanded polystyrene or its equivalent applied to the soffite. The top storey must be better insulated than the rest of the building, to reduce pronounced heating effect from the room below.

Floor insulation applied between screed and slab reduces storage of heat in the floor, and is condemned as "generally to be deprecated." Carpets or other insulating floor finishes reduce upward heat flow and indicate additional soffite insulation, and appropriate allowances in design.

Accuracy

The report suggests that seasonal energy requirements may be estimated with "fair accuracy" by conventional methods, when miscellaneous heat gains are taken into account. If the magnitude of these gains is uncertain, they may be allowed for approximately by assuming a 5°F reduction in average temperature difference between inside and outside, much as is done in degree-day methods of calculation.

For office buildings in the South of England, investigations described in the report suggest seasonal average uses of from 2,000 kWh/kW to 2,500 kWh/kW of design heat loss with floor-warming. Lower consumption is to be expected with block storage heaters.

It is concluded that fuel consumption can be estimated within the margins ±10% by conventional methods, when miscellaneous gains are known or can be allowed for.

The report follows the detailed discussion of the points summarised above with a number of appendices. One of the most important presents comment by the HVRA on six buildings heated by electric floor-heating, based on measurement of air temperature, energy consumption and floor, wall and ceiling temperatures. Another appendix discusses at length the question of air infiltration into heated buildings.

Response of rooms to off-peak floor-heating in terms of temperature-time relationships are dealt with in another appendix, and finally, the ERA contributes results from its own researches.

* The heating of buildings by off-peak electricity supplies. Report of a committee of the HVRA, Old Bracknell Lane, Bracknell, Berks. Price 5s.

new products and appliances

Switchboard push-buttons

A NEW range of switchboard push-buttons are said to have the smallest possible physical dimensions consistent with reliable performance. Rated at 5 A, 600 V, these accessories are available with either flush or projecting buttons, and are sealed against the ingress of oil by means of a neoprene diaphragm. Special adaptations can be supplied whereby the button can be locked in the "off" position by means of a knob or built-in barrel lock. Also with minimum dimensions is a range of transformer-operated indicating lamps. These employ 12 V, 2·2 W miniature lamps and have a Diakon lens available in a choice of five colours. Transformer primaries are wound for voltages in the range 100 V to 550 V. *Everett Edgcumbe and Co. Ltd., Colindale Wks, Colindeep La, N.W.9.*

Compact French refrigerator

LATEST addition to the French "Frimatic" range of refrigerators is a 5 cu ft unit, Model 500. Fitted with the American "Tecumseh" compression unit, manufactured under licence in France, the 'fridge has both full width freezing compartment and salad crisper. The door liner provides storage space for bottles and dairy foods. Model 500, finished in white stove enamel and topped with a plastics laminate surface, is 33¼ in. high, 22¾ in. wide and 24 in. deep. This model is sold at 59 gn. *Distributors: Edmundson's Supply Corpn. Ltd., Ferndale Rd, S.W.9.*

Self-priming pump range

IMPROVEMENTS to an existing range of electrically driven, vertical spindle pumps are manifest in the design of the impeller and the extensive use of malleable cast iron in the construction to combat electrolytic corrosion. The pump, which is self-priming, is intended for mounting at some distance above sump level, suction being via a light flexible hose. The impeller, driven by a directly coupled three-phase induction motor rated at 400 V, 50 c/s, is of the open type suitable for handling slurries with a high solid content. The impeller shaft has a renewable sleeve carried by large diameter ball races and the volute chamber is fitted with renewable wear plates. The range covers suction and delivery diameters from 2 in. to 6 in., typical capacities being 6,000 g.p.h. against a head of 90 ft for the 2 in. pump and 50,00 g.p.h. at 70 ft for the 6 in. pump. Weights of units lie between 6·5 cwt and 27 cwt. *Henry Sykes Ltd., 53b Southwark St, S.E.1.*

2½ kW greenhouse heater

SHORTLY after starting to sell their 1¼ kW "Autoheat" greenhouse heater through the trade on 1 May, Findlay, Irvine Ltd. launched a 2½ kW model on the market. It is a fan heater designed for the particular requirements of greenhouses. A ten-blade fan continuously draws air over an adjustable thermostat and through a heat source where the temperature is raised to 60°F. This means that if the minimum temperature in the greenhouse is 40°F, air temperature at the outlet of the heater will be 100°F. Airflow in the smaller model is at the rate of 100 cu ft/min and the 2½ kW model has a rated flow of 200 cu ft/min. Both models are finished in charcoal grey with silver grilles and feet and they are priced at £9 for the smaller model and £12 for the larger. *Findlay, Irvine Ltd., Bog Rd, Penicuick, nr. Edinburgh.*

Alarm annunciator unit

FOR industrial process control, a new alarm annunciator unit gives visible and audible warning of departure from specified limits of variables such as temperature and pressure. Two types are available, one for operation by an external circuit having normally "open" contacts, the other for normally "closed" circuits. The unit incorporates a red and a green signal lamp, the green lamp showing when conditions are normal. Operation of the external circuit lights up the red lamp, extinguishes the green one and simultaneously energises the audible alarm. By depressing a button on the unit, the audible alarm can be silenced, the red lamp remaining on until the abnormal condition has been rectified. For test purposes, an alarm condition can be simulated by operating a switch on the unit. Fabricated in robust sheet steel with two ¾ in. conduit entries, the unit is suitable for 200 V to 250 V a.c. supplies. *Londex Ltd., Anerley Wks, 207 Anerley Rd, S.E.20.*

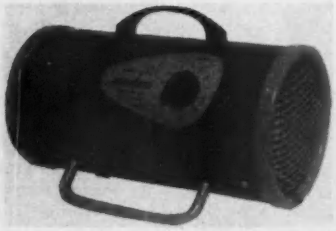
Helical precision potentiometer

HIGH precision with the elimination of backlash are features claimed for a recently introduced helical potentiometer. Its full resistance range is covered by ten turns of the spindle, with a law accuracy of within ±1% for standard models and to within 0·25% when specially ordered. Standard resistance elements can be supplied in the range 100 ohms to 30,000 ohms to a tolerance of ±5%, maximum rating being 2 W at 20°C. Overall dimensions of the body, which has an anodised finish, are 2 in. by ¾ in. dia. *Reliance Manufacturing Co. (Southwark) Ltd., Sutherland Rd, Walthamstow, E.17.*

Low impedance voltage reference

SAID to be the first of its kind available commercially, a low impedance voltage reference battery has been announced. Of the mercury type, the unit is of rugged construction, fully portable and can be operated in any position. There are two sizes, one having a single cell and giving an output of 1·35 V. The other gives a multiple output in increments of 1·35 V up to 10·8 V. Open circuit voltage accuracy is stated to be 0·5% with temperature stability of 1% between −20°F and 160°F at current drains of up to 100 μA. *Mallory Batteries Ltd., Dagenham, Essex.*

"Frimatic" 500 'fridge with full width freezer



For greenhouses, the 2·5 kW "Autoheat"

(1) Mallory Batteries' low impedance voltage reference ▶

(2) Alarm annunciator by Londex

(3) Helical precision potentiometer by Reliance Mfg. Co.

Bridges raise appliance prices

PRICES of the Bridges "Luxury Life" range of domestic appliances will be raised from 1 June. The increases vary from 9s 6d for the food mixer to 3 gn for the griddle/hotplate. Other new prices with present ones in brackets are: fan heater, £12 12s (£10 17s 6d); hair dryer, £4 14s 6d (£3 13s 6d); blankets: 60 in. by 30 in., £5 9s 6d (£5 5s), 60 in. by 48 in., £7 19s 6d (£7 15s), 53 in. by 40 in., £10 19s 6d (£9 9s). Prices of table-top appliances are also to be raised. They are: thermostat, £4 4s (£3 5s); skillet/cooker, including glass lid, £8 18s 6d (£5 19s 6d, plus 18s 5d for lid); cooker/boiler, plus lid and frying basket, £9 9s (£6 6s, plus £1 15s 6d for lid and basket). *S. N. Bridges and Co. Ltd., York Rd, S.W.11.*

Contactless heating control

NO moving parts are used in a temperature control system incorporating a "Bikini" transistorised unit used in conjunction with a saturable core reactor. The system, which will handle heating circuits having outputs up to 10 kW, is claimed to require no maintenance and to have an almost indefinite life. It is available for temperatures up to 850°C in various ranges from a minimum span of 50°C up to a maximum of 600°C. Temperature detection is effected by means of a ¼ in. diameter stainless steel bulb which can be placed up to 300 ft away from the control unit. Control differential is only 0·5°C. *Fielden Electronics Ltd., Wythenshawe, Manchester 22.*

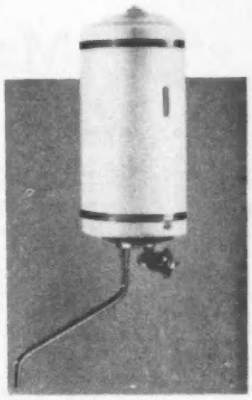
Electrical tachometer price cut

LARGE scale production of Crompton Parkinson electrical tachometers has enabled unit price reductions in the region of 30%, it is announced. These instruments incorporate brushless three-phase a.c. generators and are said to give reliable indication with rapid response. Standard speed ranges are from 0-400 r.p.m. to 0-8,000 r.p.m. with overall accuracy of indication to ±1%. *Crompton Parkinson, Ltd., Crompton Hse, Aldwych, W.C.2.*

Versatile demonstration machine

EXTENDING their range of machines for instructional purposes in universities and technical colleges, Mawdsley's Ltd. have introduced a multi-purpose experimental machine providing a variety of characteristics corresponding to both a.c. and d.c. motors and generators. Its purpose is to illustrate in a practical way the fundamental principle underlying all electrical machines while emphasising essential differences in detail between individual types.

To achieve this, stator winding connections have been brought out on to a special terminal board incorporating a mimic winding diagram. It enables connections to be made for either two- or three-phase operation with a choice of numbers of poles. The lap-wound rotor windings are connected to both commutator and slip-rings, the commutator having two sets of brushgear. One brush set is of the Schrage motor type, the other having four quadrature brushes which can be rotated relative to the commutator by means of an auxiliary motor. In addition, a pair of "search" brushes is provided for measuring potential difference at various points round the commutator. A squirrel-cage type winding can be simulated by shorting-out commutator bars. *Mawdsley's Ltd., Zone Wks, Dursley, Glos.*



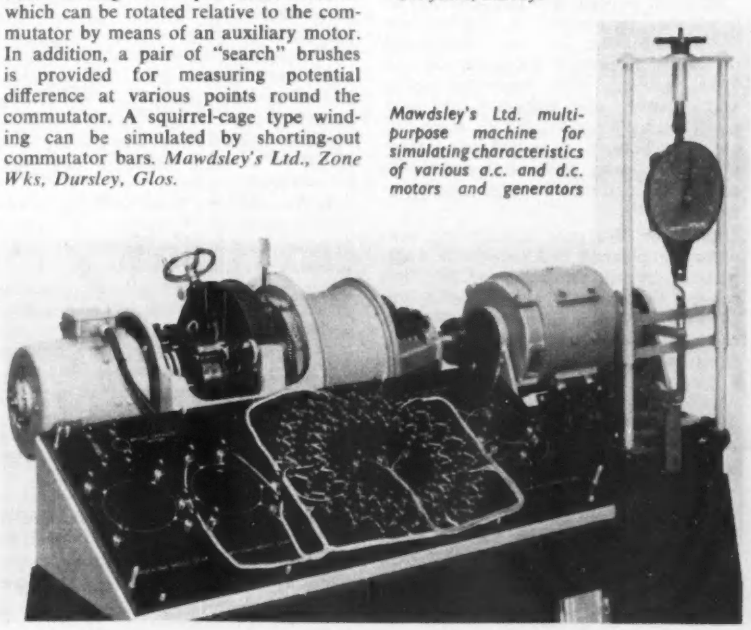
Compact 1 gal water heater, "Magiflow" by Berry's

Quick recovery water heater

CLAIMED to have unusually quick recovery, Berry's latest water heater, "Magiflow," is slim and compact. Storage capacity of 1 gal is low to ensure minimum heat losses, but fast reheating is said to be sufficient for average family needs. The heater is thermostatically controlled and has loadings of 2 kW at 250 V and 1·5 kW at 200 V. A pilot light indicator shows when the "Magiflow" is fully charged with hot water. It is finished in white or cream with chromium fittings and is 17 in. high, 7½ in. wide and projects 8 in. Basic price is £10 16s 6d, plus £2 2s 3d purchase tax. *Berry's Electric Magicoal Ltd., Touchbutton Hse, Newman St, W.1.*

Contemporary coffee table/lamp

A CONTINENTAL contemporary coffee table/lamp standard incorporates two bask raffia shades suspended from tubular brass standards. The 13 in. high table, irregular shaped and standing on three legs, has a surface of a mosaic of black and primrose ceramic tiles. Overall height is 5 ft 5 in. and retail price, 16 gn. *Uncles, Bliss and Co. Ltd., New Parade, Cherry Orchard Rd, East Croydon, Surrey.*



Mawdsley's Ltd. multi-purpose machine for simulating characteristics of various a.c. and d.c. motors and generators

TRADE PUBLICATIONS

CAMBRIDGE.—Two leaflets, one giving details of vapour pressure thermometers and the other dealing with recording counters which record the frequency, clock time and duration of industrial processes or machine operations. Cambridge Instruments Ltd., Grosvenor Pl, S.W.1.

E.E.—Two booklets, one an index of valve replacements and the other dealing with range of Magnetrons designed by English Electric Valve Co., Chelmsford.

LONDEX.—Data book giving details of relays and electrical automatic control apparatus. Londex Ltd., Anerley Rd, S.E.20.

NELSON.—Brochure illustrating non-standard static or rotary electrical plant and equipment. Nelson Engineering Co. Ltd., Netherfield Wks, Nelson, Lancs.

PAYNES.—24-page brochure designed to show wide range of packaging and labelling products. P. P. Payne and Sons Ltd., Haydn Rd, Nottingham.

ROYCE.—Illustrated leaflet describing "W" and "T" type hump-back conveyor furnaces. Royce Electric Furnaces Ltd., Sheerwater, Woking, Surrey.

SANTON.—New price-list issued for months of May, June and July and leaflet giving specification of automatic heating for swimming pools. Santon Ltd., Somerton Wks, Newport, Mon.

SIMPLEX.—Illustrated data sheet and price list of flameproof equipment and 88-page catalogue of lighting equipment. Simplex Electric Ltd., Creda Wks, Blythe Bridge, Stoke-on-Trent.

S.T.C.—Three booklets and a technical data sheet. Brochures deal with transistor superheterodyne receiver; valves and equipment wires; data sheet refers to types of telephone relays. Standard Telephones and Cables Ltd., Connaught Hse, Aldwych, W.C.2.

STEWARTS AND LLOYDS.—Attractively produced booklet with coloured plates and line diagrams illustrating applications of hollow structural steelwork. Stewarts and Lloyds Ltd., Broad St Chambers, Birmingham 1.

Materials for Electrical Design

NEW EPOXY RESIN

CRACK-RESISTANT castings are an application for which a new Shell Chemical Co. epoxy resin, Epikote X-71, is particularly recommended. Another use is for encapsulation of electrical components where flexibility and resistance to mechanical and thermal shock is important. Epikote X-71 is a low viscosity resin specially developed to impart flexibility to Epikote resin composition. It may be used for combination with other liquid resins to increase significantly flexibility, impact strength and toughness of the cured composition. *Shell Chemical Co. Ltd., 170 Piccadilly, W.1.*

SILICONE RUBBERS

TWO more silicone rubbers have been introduced by ICI Nobel Division. One is Silcoset 103, a white solvent-free paste which cures at room temperature to a resilient silicone rubber when the appropriate curing agent has been added. This is similar in properties to pink Silcoset 100, available since last year. It is recommended for high temperature sealing, patching, caulking, potting and encapsulation of sensitive electronic assemblies. The other new introduction is a thixotropic material, Silcoset 104, which can be readily bonded to primed metal surfaces. *ICI Nobel Division, Imperial Chemical Hse, Millbank, S.W.1.*

HIGHER CONDUCTIVITY SPRINGS

A NICKEL-SILICON-COPPER alloy is now available under the name Mallory 53 to meet the need for an improved electrical instrument spring material. Mechanical properties are at least equal to those of conventional phosphor bronzes and brasses, but with appreciably higher electrical conductivity. Applications are expected to include miniaturised electrical components. Conductivity is between 40% and 45% IACS, and higher current carrying capacity for springs of a given size is possible than with phosphor bronze. All spring-forming operations can be applied to Mallory 53 after heat treatment, so the alloy is supplied to users in the precipitation hardened condition, requiring no further heat treatment. *Johnson, Matthey and Co. Ltd., 73-83 Hatton Garden, E.C.1.*

NYLON POWDER

A NYLON powder suitable for dip and spray coating produced in Britain has been announced by Dohm Ltd. The material is suitable for dip coating or flame spraying and is called Dohmpowder Nylon. The firm is also marketing a polyethylene for similar applications. *Dohm Ltd. (Plastics Division), 167 Victoria St, S.W.1.*

Corrosion resistance	High except against mineral acids.
Electrical resistance	600 V for 0·001 in. thickness.
Limits of deposit by dip coating	0·010 in. to 0·025 in.
Limits of deposit by flame spraying ...	0·010 in. upwards.
Melting point ...	190°C.

U.G. RAILWAY REVIEW

INTERNATIONAL plans for underground railways in city centres and suburbs are summarised in a British paper presented to the International Union of Public Transport in Copenhagen last week. The author, Mr B. H. Harbour (London Transport Executive), surveys the development of metropolitan railways and arguments in favour of their use.

In Paris a deep underground railway is planned to provide an express type of service between the outer suburbs and the more important junctions on the Metro network. Two transverse routes are planned, one east-west and one north-south. Work is due to start this year. In Toronto a second sub-surface railway is being built, and a ten-mile route length should be working by the end of 1969.

In Japan five new underground railways are planned in Osaka, with completion currently scheduled for 1975, but there is a prospect of some speeding up. Moscow has currently under construction some 60 km of urban railways. Extensions are planned in both Moscow and Leningrad.

Passenger Conveyor

Amongst cities planning new city railways is Atlanta, Georgia, USA, where a continuous moving belt carrying six-seater cars is planned. The idea is that this will run at an average speed of 15 m.p.h. between stations and slow down to 1½ m.p.h. at stations, where passengers will board and alight from the cars on to parallel belts moving at the same speed. The cars will operate in a transparent plastics tube carried at first-floor level above the streets. Known as a "Carveyor," the system could have a capacity of 20,000 passengers/hr in each direction while the cost ($59 million) would be only one-fifth of constructing the equivalent "Expressways" for cars.

Los Angeles is another city planning some automatic system joining the peripheral car parks with a central area. At present, rubber-tyred trains running above city streets are envisaged with 21·6 mile route length handled in this manner with 2·3 mile route length in tunnels. Underground construction was found to be more expensive than such an overhead system.

In Washington, trains running in the middle strips of "freeways," descending to sub-surface level in the city centre are planned. A feature will be the use of either rubber-tyred wheels on concrete, or steel wheels on steel rails with rubber cushions between rails and sleepers and between cars and bogies. San Francisco has plans for a four-mile long "earthquake proof" tube to cross the bay between that city and Oakland.

A feature of the American plan is that monorail methods have been generally considered, but rejected.

Rotterdam is currently building an underground railway of 5·2 km length and Oslo one 27 km long. Milan has a 12·5 km line due to be opened in 1962 using a novel civil engineering construction method.

NEW SUPERCONDUCTING ALLOYS

ALLOYS that can be superconducting at temperatures well above those of other materials have been announced by Bell Telephones Laboratories of New York. Other alloys remain superconducting despite strong magnetic fields. Earlier this year a niobium-tin alloy was announced which had the advantage of remaining superconducting in magnetic fields as large as 88 kG at temperatures up to 4·2° absolute. This material, however, was very brittle, so that its use for magnet coils involved mechanical design difficulties. Materials now announced include an alloy of molybdenum and technetium which is superconducting at temperatures near 16° absolute. Another material is an alloy of niobium and zicronium which, although not remaining superconducting at such high temperatures, nevertheless keeps its superconducting properties in magnetic fields of 80 kG at 1·5° absolute. Superconducting materials of this type are of interest for magnet windings, in telecommunications and possibly thermonuclear apparatus. *Bell Telephones Laboratories, 463 West St, New York 14.*

ELECTRICAL TAPE

INTRODUCED by John Gosheron and Co. is a cellulose acetate electrical tape suitable for use in manufacture of small coils using fine copper wires. The tape has an upper working temperature of 130°C for several hours in the absence of electrical stress, which means that it can withstand drying out procedures in coil manufacture successfully. *John Gosheron and Co. Ltd., The Packaging and Industrial Tape Centre, Albert Embankment, Vauxhall, S.E.11.*

News of the Week

Eastern Board Raises Tariffs

Floor area basis eliminated from domestic fixed charge

THE last of the boards to raise prices in the current round following Sir Robertson King's statement last autumn, the Eastern EB have announced tariff increases which will take effect on 1 October. Unit charges to domestic consumers will rise by ¼d to 1½d, the first increase in this sector for more than four years. Industrial consumers, because their last tariff change was in 1959, will have a relatively smaller increase of 1s/kW or kVA of maximum demand. However, all off-peak tariffs, domestic and industrial, remain unaltered.

At the same time Eastern EB have taken the opportunity to simplify their tariff structure. The sliding scale of fixed charges for domestic premises, ranging from £1 4s 11d to £3 3s 11d a quarter according to floor area, will be replaced with a uniform 1s 11d a week, which is the same as the present minimum.

In the domestic tariff, introduction of an automatic maximum price of 6d/unit (7d for pre-payment meters) will enable the Domestic Block Rate to be withdrawn, further simplifying the charges. The uniform fixed charge in the domestic tariff has been incorporated in the combined premises tariff and in the farm tariff so that in Eastern areas it will no longer be necessary to assess the floor area of any consumer's premises.

In line with past policy, it is now hoped to keep domestic tariffs steady for three or four years. The Consultative Council, which met immediately before the increases were announced, was sharply divided on this point. The Council decided by a majority of only two votes to recommend the ¼d increase, with the minority opting for a ¼d increase, even though this would not remain stable for so long a period.

On the delay in the application of the increases, the chairman of the Council, Ald W. J. Bennett, said he had been able to obtain this concession from the area board because of the beneficial effect on funds of the recent mild winter. As a result, the new tariffs will apply from the first meter reading following 1 Oct., which means that most consumers will not begin to receive accounts covering the higher charges until early next year.

PATENT DELAYS

FOR the first time in eight years the Comptroller General of the Patents Office is able to report some catching up with arrears. Although in 1960 there were 1,759 more complete patent specifications to be examined than in 1959, arrears of unexamined specifications were cut back by nearly 400.

Commenting on criticisms about the length of time it takes to obtain a patent, the Comptroller says an application can be accepted and published within 18 months. However, this depended on an applicant dealing promptly with questions raised by examiners. In fact, 50% of applications are accepted within two years, but 20% involve such prolonged correspondence and negotiation that acceptance takes more than three years.

More than half the complete specifications examined by the office during 1960 came from abroad, and preliminary consideration under the auspices of the Council for Europe has been given to the possibility that a single patent application may give simultaneous protection in several countries.

HOUSEWIVES SELL GAS

NORTH Western Gas Board is offering commission to members of the Women's Gas Federation for any sales they promote of gas appliances and heating systems. The commission will be paid on the same scale as that paid to the board's employees. Mr H. Butters, a member of the Board whose area covers N.W. England, announced the offer at the Federation's annual conference at Blackpool last week.

132 kV Faults shut down S.E. England

SEQUENCE tripping of lines on the 132 kV system led to extensive failure of supplies on Monday evening (15 May) in London and the South East. This opinion was offered provisionally by the CEGB soon after supplies were restored. The suggestion was that an earth fault or faults began the trouble, and that cascade operation of protective gear followed.

At the time of going to press, CEGB enquiries were continuing to establish the details of the shutdown. Sequence tripping to the extent experienced should not normally follow faults, of course. Supply was interrupted at 9.27 p.m., and restoration was completed by midnight. In London, the City and the southern and south-eastern suburbs were involved, and Kent to the coast, Surrey, Sussex and Hampshire all lost supply.

At the time the fault occurred, some transmission lines and generating sets were out of commission for normal summer overhaul, but this had been planned with normal regard for the security of the system.

The 275 kV system was not affected by the faults; but this comes at present only to the north-western boundary of the area affected.

The CEGB statement concluded "It appears that investigations may show that the trouble was precipitated by coincident disturbances at more than one point."

Loss of traction and signalling supplies affected trains on the Southern Region system.

In 1951, there was an extensive supply interruption in the north-west of England as a result of cascade tripping. In that case, however, it was an unexpected increase of load that caused the trouble, following shortage of generating capacity.

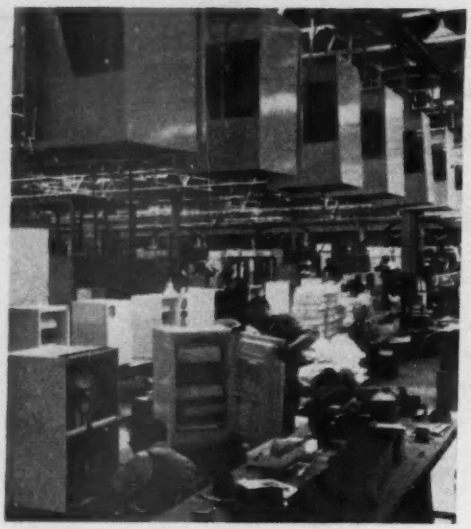
DEFECTIVE EARTHING

INSPECTIONS by the NICEIC continue to reveal defective earthing in a disturbingly high proportion of installations visited. The Council's progress report for the first quarter of 1961 shows 4½% of installations examined to have unsatisfactory earthing or inoperative earth-leakage circuit-breakers. This is higher than for the previous quarter.

Out of 2,251 installations examined, 57 had ineffective earthing, and 39 inoperative circuit-breakers.

One technical advance is reported. "At long last"—to quote—"it can be reported that the number of deviations recorded under Reg. 207G of the IEE Regulations (total enclosure of wiring connections to accessories and other equipment and apparatus) shows definite signs of diminishing."

Early publication of the fifth edition of the Roll of Approved Contractors is promised. In the quarter covered by the report, 56 applications for enrolment were approved by the NIC's National Inspection Board, eight applications were rejected, and 37 were deferred for further inspections. 41 firms were removed from the roll, but no less than 105 new applications for enrolment were received, more than in any previous quarter.



Morphy-Richards open Dundee Factory

Mr R. Wood, MoP, officially opened the largest appliance factory in Scotland last week for Morphy-Richards (Astral) Ltd. The factory, at Gourdie on the outskirts of Dundee, covers eight acres and almost doubles the production area of Morphy-Richards, who have three other factories at Dundee and factories in Kent. The building, leased from the BoT, cost £1½ million to erect and is designed to the company's requirements. The most up-to-date equipment has been installed; for example, six automatic painting machines are electronically controlled. Our picture shows final assembly of refrigerators

E.T.U. CASE CONTINUES

A CHANGE in rule which meant that branches no longer had the right of appeal against an Executive Council's decision on a scrutineer's report was raised during cross examination of Mr F. Haxell and other officials of the Electrical Trades' Union in the High Court action. Mr J. T. Byrne and Mr F. Chapple are seeking a declaration that Mr Haxell's election was void, and ask for damages for conspiracy against Mr F. Foulkes, president, Mr Haxell and 14 other officials.

Mr T. E. Vincent, a former member of the Executive Council, said that at the 1957 Rules Revision Conference, no one had explained to the delegates that one of the proposed rule changes meant that branches would in future have a right of appeal against an Executive decision on area boundaries, and he did not think anyone made it clear that another change eliminated their appeal rights in elections.

Earlier, during cross examination of Mr Haxell, Mr Justice Wynn told him that he should have appreciated that one of the main questions in the case was whether he (Mr Haxell) genuinely believed that either he or the executive council could reject any appeal against the acceptance or rejection of a scrutineer's report under the broad rule that the executive was responsible for the conduct of elections. What better way was there to prove that he genuinely believed that was the position than by producing instances of where it had been done? Mr Haxell said he could not recall any such instance in the past six years. His Lordship commented: "I want to make it clear to you that I have begun to form my own assessment of your intelligence, how much intelligence and ability you have. That will be one of the factors I shall bear in mind when I come to weigh up the important question of whether you did hold certain bona fide opinions about the meaning and scope of the rules from time to time."

The hearing continues.

SILVER JUBILEES

THE first week of June brings the silver jubilee of Londex Ltd., who claim to have produced over two million electromagnetic relays during that period. The company now make a wide range of automatic controls, from small precision relays to large panels for complete manufacturing processes—all produced at their Anerley Rd factory—and there are now 400 employees. The firm also has its own companies in Paris and Munich.

THE revolutionary Pyrotenax cable has been such a prominent feature of electrical installations that it is difficult to realise that it has been in use here for 25 years. In fact, Pyrotenax Ltd., the British company, was formed to exploit the French patented cable. Starting with 12 employees in 1936, the total personnel of the company today is well over 1,000, with factories in Australia and Canada. During the same period the range of cables has risen from 25 sizes and types to 200. The company celebrated its jubilee at a dinner earlier this month.

Stadium chooses infra-red heating

THERMODARE infra-red radiant heating of 250 kW capacity is being installed at Shawfields Stadium, Glasgow, to counteract the attraction of warm homes and television for football and greyhound racing fans next winter. The stadium is providing patrons with a new standard of comfort, for this is the largest installation of its kind by Thermodare and probably the largest in the UK. The 80 ft long glass-fronted bar is already equipped with Thermodare infra-red heating.

Consumer Protection Report Early 1962

EARLY 1962 is the target date for presentation of the report of the Board of Trade's committee on Consumer Protection. This was stated in the House of Commons last week. A suggestion that there should be interim reports received no support from the Minister concerned. The committee has been sitting for something like two years. The Government thinks that all the various points it has to consider are related. For that reason, to ask for interim reports would hold up progress with the final report.

OFFICIAL PUBLICATIONS

Heating of Buildings by Off-peak Electricity Supplies. Heating and Ventilating Research Assn. Report, 5s (see page 803).

HM Inspector of Mines and Quarries. Report for Northumberland and Cumberland Division. HMSO. 2s 6d.

British Non-Ferrous Metals Research Association. Report for 1960 (see page 812).

Trading Opportunities in Europe. Export Council for Europe report.

Patents, Designs and Trade Marks. Report for 1960. HMSO. 1s 6d (see page 807).

ERA Publication: L/T394. Resistance of Sheet Insulation to Surface Discharges. II, J. H. Mason.

British Standards amendment slips: 171, Power Transformers, PD 4108; 764, Automatic Changeover Contactors for Emergency Lighting Systems, PD 4123; 1539, Moulded Electrical Insulating Materials for use at High Temperatures, PD 4126; 1598, Ceramic Materials for Telecommunication and Allied Purposes, PD 4119; 1633, Steel for Land Boilers, Receivers and Other Pressure Vessels, PD 4105; 2562, Cable Sealing Boxes for Oil-immersed Transformers—Part 2: 1959, Boxes for 22 kV and 33 kV Solid-type Cables, PD 4130.

Trade Literature Competition

IN the results of the 1961 manufacturers' trade and technical literature competition organised by the Royal Institute of British Architects in conjunction with the Building Centre, four electrical manufacturers are named from the 106 firms who submitted entries. In group 1a, Courtney Pope (Electrical) Ltd. and Marryat and Scott Ltd. receive honourable mentions. Falk, Stadelmann and Co. are awarded a certificate of exceptional merit under group 1c, with GEC gaining an honourable mention. There has been a marked improvement in the standard of the entries, and the assessors believe that the competition should be continued.

Rail Chief praises Locomotive Manufacturers

RAILWAY engineers and manufacturers working on electrification projects have gained experience from their recent troubles which gives them the lead in this form of engineering. So said Sir Brian Robertson, BTC chairman, when he lectured to the Institution of Locomotive Engineers last week. However, he thought the time had come for the cost of electric locomotives to be cut.

Speed and high reliability were suggested by Sir Brian as essential requirements if railways were to stand up to increasingly fierce competition from road and air. The main-line diesel locomotive, like the electric locomotive, was too dear for the advantages it gave. Electric locomotives, however, had the advantage over diesel of a considerable reserve of power which could be drawn on heavily for short periods. This should be a big help in improving punctuality.

Steam heating of diesel- or electric-hauled passenger trains ought to be abandoned quickly. It seemed ludicrous to Sir Brian to exchange a steam engine for an expensive diesel or electric locomotive, and then mount a large steam boiler and water tank on the new locomotive. There had been progress towards a changeover to electric heating, but this needed to be pushed more vigorously, even if some carriages had to be fitted with both methods for a while.

Sir Brian defended manufacturers against allegations of insufficient testing of electrical equipment. The history of railway engineering suggested that revolutionary changes of the kind involved never revealed all their problems until the system was put into full working service. It was clear to him that no trouble that had developed on the new services could be described as basic. There was no trouble which would not be quickly overcome.

Railways Order Centralised Control

AN advanced system of centralised control of railway track which would greatly reduce the number of signal boxes and provide automatic operation of road barriers at level crossings is to be tried out by British Railways. Westinghouse Brake and Signal Co. have been awarded the contract to install the system on the 31¼ miles of route between York and Beverley. Central control will be at York, and of nine other signal boxes only two are being retained. Savings of manpower will also result from changing 20 of 23 level crossings from manual to automatic operation.

This full-scale trial will be one of the largest centralised control installations in the country. Results will determine what part the system will play in the railways' modernisation plan.

Battery Vehicles Go Ahead

THE steady increase in the number of battery-driven vehicles on UK roads continued in 1960, rising by 4·4% to 38,184. No statistics are available for those used indoors or on private property, but the annual report of the Electrical Vehicle Association states that 80% of all inquiries received by members during the year were for industrial and hospital uses, against 58·8% in 1959.

The manufacturers claim that the UK industry is "undoubtedly" the largest of its kind in the world and point to their contribution to the balance of payments by saving on imported fuel.

Factory with 527 kW floor-warming

CLAIMED to be the largest timber-constructed factory in Europe, the new Mansfield, Notts, factory of Foister Clay and Ward Ltd., officially opened last Friday, has Thermodare withdrawable type electric floor-warming with a total load of 527 kW. With 42,600 sq ft of floor area, it is one of the largest single floor areas to be heated by this method. As with the concrete foundation, the heating installation is divided into separate units, with thermostats controlling limited groups of heating circuits to maintain the 65°F air temperature required for the comfort of the large number of women workers who will be comparatively static working at small machines. Erection of the building was completed in 14 weeks, despite difficult weather conditions.

LARGE CONTRACTS

A CONTRACT valued at nearly £750,000 for the supply and installation of cables at Blyth "B" power station has been placed with Pirelli-General Cable Works Ltd. by the Northern Project Group, CEGB.

Electric controls for four 100 ft travelling missile service towers for rocket establishments at Woomera, Australia, and Spadeadam, in the UK, have been supplied by Brookhirst Igranic. The controls propel the tower to and from the launching platform, raise the missile from horizontal to vertical position and operate a lift which serves seven floors inside the tower.

The entire electrification contract for the new £1 million dry dock of the Mercantile Dry Dock Co. has been carried out by Johnson and Phillips Ltd. The cable work included three-core 22 kV and 6·6 kV cables, and some three miles of smaller size down to 0·0225 sq in. Four 6·6 kV switchboards were required for three new substations and the Dock Pump House control panel, in addition to 11 power transformers of various sizes up to 2,000 kVA. Incoming supply is taken from the North Eastern Electricity Board at 20 kV.

AUTOMATIC CAR PARK

WHAT is claimed to be the first automatic car park to be built by a public authority in the UK was officially opened by HRH Princess Margaret last Thursday at Woolwich. The eight-storey building provides parking space for 256 cars, on either side of a central well, each car being transported to and from its allotted station automatically by the operation of a keyed button in the entry kiosk at ground level. The Autostacker is the idea of a civil engineer, Mr J. A. Stirling, O.B.E., M.I.C.E., who, in association with John Brown and Co. and Standard Telephones and Cables Ltd., have formed the company of Auto-Stackers Ltd. to market the system. The whole of the electrical control system was developed, constructed and installed by Standard Telephones and Cables Ltd.

Parking in the Sky

The 256-car Autostacker park at Woolwich with, below, a customer applying for a key at the kiosk. This key ensures that the car will be safely stored and delivered to no one else but the customer when required

Winners of speech contest

Mr Geoffrey T. Love, winner in the men's section of the EDA public speaking competition, and Miss Ann R. Crawford, winner in the women's section, shown holding their Faraday Silver Challenge shields. Mr Love is a service representative in Weymouth District of SEB, and Miss Crawford is a demonstrator in Burton-on-Trent District, EMEB. Runners-up were Mr Graham P. Hobbs (SWEB) and Mr Alfred J. Imray (North of Scotland HEB), and in the women's section Miss Angela G. M. Lyon (SEEB) with Miss Fiona A. McFadyen (North Scotland) and Miss Anne B. Clarke (EEB) tying for third place

A PARTICULARLY high standard of presentation was attributed to the women entrants in last week's national finals of the EDA public speaking competition for area board personnel. But the men were "more than half as good," said one of the adjudicators, Mr D. Williams, who is deputy education and training officer of the Electricity Council. The criticism most generally applied to the men was that of speaking in a monotone, but there were exceptions, notably from north of the Border.

There were more finalists than in any previous year, with 13 women speaking for 10 min to 15 min each on a variety of electrical subjects on Wednesday, followed by 12 men on Thursday.

Miss Mary George, the EAW director, was on the panel, and one of her suggestions on the second day was "when talking to an audience of women don't angle all your jokes against women; try to angle a few against men."

Vacation Course for Post-Graduates

THE Electrical Engineering Dept. of Imperial College, University of London, is organising a vacation course this September. The subject is "The General Theory of Electrical Machines." Under the direction of Dr B. Adkins, the course will provide an introduction to modern methods of calculating the performance of d.c. and a.c. machines under any conditions of operation. It is intended for engineers working in the manufacturing and supply industries, and in the Electrical Engineering Dept. of universities and colleges, and will be held from 18-22 Sept.

MORE TV TAKEOVERS—

Thorn acquire Ultra interests; Plessey buy Regentone factory

TWO further steps in the rationalisation of the hard-pressed TV manufacturing industry occurred in the past week. The larger of the deals was by Thorn who took over the whole of Ultra Electric (Holdings) Ltd's interests in this field. The other was the purchase by Plessey for £507,000 of the Regentone factory at Romford from Lloyd's Packing Warehouses.

The price paid by Thorn is about £2·4 million cash, for which they acquire the entire capital of Ultra Radio and Television Ltd., Pilot Radio and Television Ltd. and the subsidiaries of both these companies. The purchase includes Ultra's modern factory at Gosport and other premises at Ruislip, Eastcote and Park Royal. Thorn say this will further consolidate their position as the largest group in the industry. Ultra (Holdings) in which an American group recently obtained a 40% share, will now concentrate on the electronics side of their business, and say that their 25% dividend rate will be maintained this year.

While these moves reduce the number of competitors, there is again reluctance to relinquish established brands. Thorn say they will preserve the separate identities of Ultra and Pilot. The case of Plessey is somewhat different; they do not market TV sets themselves, nevertheless the Regentone and RGD marks will not disappear. Plessey will now manufacture these goods to the specifications of Regentone Products Ltd.

More Severn Stations?

DESPITE official assurances that discharges into the Severn from the cooling plant at Berkeley nuclear power station will be safe to drink even before dilution by the river, Mr F. V. Corfield, MP for South Gloucestershire, is worried at possible expansion plans. He does not find the fact that it may be necessary to have further nuclear power stations on the bank of the Severn "a very attractive proposition." Apparently, the bank of the Severn affords the nearest series of suitable sites. But he says that in opposing developments of this type he has found that he has received singularly little help from local authorities. Their main consideration was, it seemed all too often, the additional income likely to accrue to the rates.

Safety Win for Bristol

SOUTH WESTERN EB's trophy for the district with the best safety record in the area has this year been won by Bristol District. Runners-up were Crewkerne District. Presenting the trophy at Bristol last week, Mr A. N. Irens, chairman of SWEB, said that over a third of the accidents in the supply industry in the South West are non-electrical.

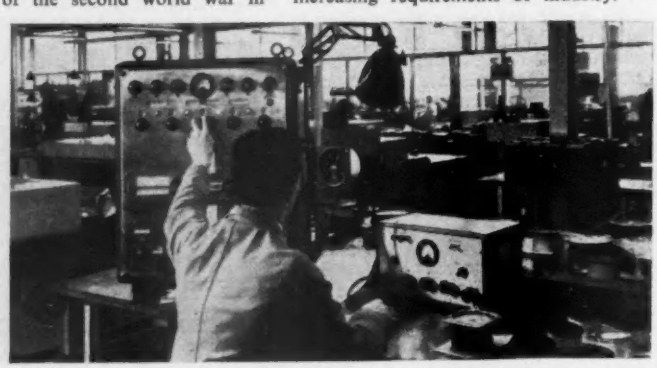
Golden Jubilee of Record

NEXT month marks the golden jubilee of the formation of the Record Electrical Co. Ltd., the instrument firm which has operated from Broadheath, near Altrincham, throughout its 50 years. Formed by John Westmorland Record, the concern has steadily grown from those small beginnings to its present prominent position with a modern plant where over 500 people are employed—46 of them having over 25 years' service with the company.

The range of instruments, too, has been continually extended, but the manufacture of circuit-breakers, initiated in the early years and suspended at the beginning of the second world war in order to concentrate resources on instruments only, has now ceased.

One other major change occurred in 1955 when a merger with Evershed and Vignoles Ltd. was agreed as being of mutual advantage, and the latter company assumed financial control, but otherwise, apart from an interchange of directors, both companies continue to function as separate entities.

Today, the demand for "Cirscale" instruments and other products manufactured by the company is greater than ever, and its development policy aims at expanding production to meet the increasing requirements of industry.



A calibration bench at the Altrincham works of the Record Electrical Co. Ltd.

This striking lighting effect at the showroom of Stour Valley Vehicles Ltd. has been achieved by the use of 40 standard 6 ft by 4 ft "Brite-Glo" ceiling panels supplied by Courtney, Pope (Electrical) Ltd. The level of illumination is approximately 25 lumens / sq ft. Contractors were Newey & Eyre, with installation under the supervision of Mr. R. H. Whitehouse, group architect

N.C.B. spend £3¾m on Power Stations

MAJOR modernisation of their electricity generating facilities in South Wales is being undertaken by the National Coal Board. New plant to be bought is four 15 MW turbo-alternators and eight slurry-burning boilers, three of 150,000 lb/hr capacity and five 60,000 lb/hr. With the exception of one relatively new 15 MW Metropolitan - Vickers turbo - alternator which is being retained, these will replace all of the existing plant in the two main stations supplying collieries in the Rhymney and Aberdare valleys through the NCB's own 33 kV and 11 kV grid. These stations are a 46 MW installation at Bargoed and 25 MW at Middle Duffryn; present output will not be greatly altered.

Contracts have already been placed with Richardsons Westgarth for the first two 60,000 lb/hr boilers, and Hawker Siddeley Brush have received the order for the first 15 MW turbo-alternator. It is understood that the contract for the next 15 MW set is about to be placed.

Overall cost will be £3¾ million, including complete rebuilding of the power house at Middle Duffryn. In addition, £1 million will be spent to replace old air compressing plant at Bargoed. The NCB's only other generating plant in the area is a 5 MW station recently built at Penallta, which served as a pilot for the unsaleable slurry.

Retail Sales High

THE post-Easter period saw no slackening in the high level of consumer demand. The BoT preliminary index of value of retail sales moved up one point from March to April but volume was steady allowing for a rise in prices.

Meanwhile, radio and TV retailers report better trading in March. Radio sales were particularly bright, with an average of 14·4 per shop against 13·2 a year earlier and 11 in February this year. TV improved fractionally on February, but was still 20% below last year.

Exports Convention in November

A FIRM opinion that British exports to Europe can be "substantially expanded" was voiced by Sir William McFadzean when he announced last week that the Export Council for Europe will stage a national convention at Eastbourne from 28 November to 30 November. The first-hand experience brought back from nine countries by "pathfinder" missions will form a basis for many of the discussion groups at the convention, which is designed to spread knowledge among exporters.

Mr MacMillan and Mr Maudling have already accepted invitations to attend. Although the convention has no specific title as yet, accommodation has been reserved with about 600 delegates in mind. These will include business men from all over the country as well as sales representatives and Embassy commercial staff from the Continent.

Asked about the vexed question of quality, in view of the suggestion by the mission which he led to Spain that the question of "lowering of sights" from CEGB standards should be investigated, Sir William said he sympathised with the heavy electrical manufacturers and he did not know the answer. In many fields, he said, the technical quality of British goods, as distinct from "luxury" quality, was being advanced as a major selling point. On the question of how firm are Spain's plans for seven nuclear stations over the next 15 years (reported by us last week) Sir William reiterated that they are determined to industrialise and further hydro development is limited.

UIE delegates visiting Garringtons' Works, left to right, Prof. Mazur (Poland), Mr Zandstra (British Committee member), Mr S. Szepesey (Hungary), Mr De Ruiter (Holland) and a representative of Garringtons, interested in an induction billet heating plant

NUCLEAR REACTORS FOR UNIVERSITIES

THREE nuclear reactors for British universities have been approved in principle by the Government. One will be sited in Scotland, one in Lancashire and one in the London area. Exact sites have not been agreed, although the Government admits "considerable delay" since projects for university reactors were first mooted; they defend this delay on grounds of cost of reactors.

Few Appliances in Nicaragua

A NUMBER of factors combine to make Nicaragua a poor market for domestic appliances. To begin with, the 110 V, 50 c/s supply is at present limited to the western half of the country. This area contains about two-thirds of the 1·4 million population, of whom only a fraction are potential buyers. Not only are servants cheap, but they are also liable to break any gadget. Imports of all portable electrical goods barely exceed £50,000 a year, practically all coming from the US and a sizeable proportion accompanying travellers duty-free, according to a survey in the Export Service Bulletin.

Electroheat Congress

PREPARATIONS for the fifth International Congress on Electroheat, to be held in Germany in September, 1963, were discussed at some length at the first annual meeting of the Union Internationale d'Electrothermie (UIE) executive committee in London recently. Twenty-two foreign delegates attended, and during the meeting the admission of a new member country, Greece, was approved, bringing the total membership of the UIE to 15 countries. At the 1963 Congress, about 120 papers on all aspects of the use of electric heating for industrial processes will be presented.

During the four-day meeting, arrangements for which were made by the British National Committee on Electro-Heat (whose secretariat is provided by EDA) delegates visited the Bromsgrove works of Garringtons Ltd. and Hinkley Point nuclear power station.

New Lighting for Windsor

WINDSOR'S redecoration and general improvement scheme, officially opened by HM the Queen last Friday, includes new road lighting in Thames St, High St, Castle Hill and St. Alban's St, the contract for which was awarded to Atlas Lighting Ltd. Alpha Three lanterns, with 400 W mercury fluorescent lamps have been generally used, with 80 W and 125 W types at the end of Windsor Bridge and for group "B" lighting in St. Alban's St. Surplices Ltd. did the wiring and Wellman Bros. and Co. manufactured the control gear boxes.

In four new floodlighting attractions in Windsor, Philips Electrical Ltd. were involved. The Guildhall has eight 500 W lamps mounted on adjoining buildings, with the colonnade partly silhouetted by three lamps mounted on the inside of the cornices. Sodium lamps are used for lighting the front of St. John's church, with white tungsten employed for the tower, and sodium for the war memorial. A coloured cyclorama surrounds the beauty of the Lutyens work on the King George V memorial.

Closer View of Royal Tour

PERSONAL glimpses of the Queen and Duke of Edinburgh's tour of Pakistan and India earlier this year were recounted by Mr Godfrey Talbot, senior reporter of the BBC, at the Electrical Industries' Club luncheon last week. His talk, "21,000 miles through Asia," showed that as well as protocol there was a great deal of informality. Mr Talbot is the BBC's accredited representative at Buckingham Palace and accompanies the Royal Family on most of their overseas tours.

Mr Denzil Freeth, Parliamentary Secretary to the Minister for Science, will be guest speaker at next month's luncheon, which will be held on 13 June.

Sayings OF THE WEEK

"Coal by wire is about the best way you can use the fuel we produce." . . . MR A. ROBENS, NCB chairman, speaking at the EDA luncheon.

"It is quite clear to me now that no trouble has developed on the new services which can be described as basic and which will not be quickly overcome." . . . SIR BRIAN ROBERTSON, BTC chairman, speaking of trouble with electrification.

"When the waist-line precludes the Outward Bound type of activity, a lot of excitement and adventure can be had from the insecurity. The better the job, the more people are after it with their knives out." . . . MR H. E. ROFF, at conference of North Region of Institute of Personnel Management.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, May 16

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	244½	+1½
" (3 months)	245¾	+1½
LEAD, refined pig, 99·97% purity (cash)	67	−¼
" (3 months)	68¼	−¼
TIN, refined, min. 99·75% purity (settlement)	869½	+6½
(3 months)	873½	+7½
ALUMINIUM, ingots 99·99·5% ...	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	211½	+3
SILVER (Troy oz)	79¼d	—
ZINC, virgin, min. 98% purity (cash)	81	−2½
" (3 months)...	81¾	−1½
RUBBER, per lb. No. 1, RSS. spot	26½d	+¼d
c.i.f. basis, ports, July ...	26½d	+¼d
ARMOURING: Galv. Steel Wire (0·104 in.) ...	67½	—
Mild Steel Tape (0·04 in.) ...	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	67	—
AMERICAN PRICES: Copper, electrolytic (per lb) ...	30c	—
Lead. (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

NON-FERROUS RESEARCH

RESEARCH activities of the British Non-Ferrous Metals Research Association are reviewed in the annual report for 1960, presented to the Association's annual general meeting last week. Sixty major projects are in hand, covering a wide range of topics. The report shows that the Association is devoting more attention to development work and short-term specific researches.

Corrosion of condenser tubes through impingement attack by polluted water has been under investigation for some years. A research in which several new condenser alloys for use in such conditions have been developed was brought to an end during 1960 and trials are now proceeding with condenser tubes with these materials.

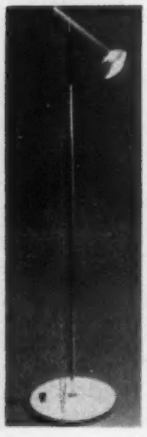
Electroplating research by the Association has been principally concerned with improving the durability of chromium plating. The validity of several accelerated corrosion tests is being compared.

Several researches are reported, concerned with the manufacture and properties of high conductivity copper wire. A test has been developed for assessing alternative die materials, and for checking die lubricants. Another research has been started on some facets of continuous lead extrusion.

Successful development of alloys for lead cable sheathing is reported, the advantages being improved structural stability, creep and fatigue resistance. Large scale trials are now in hand.

DESIGN AWARDS 1961

A PORTABLE transistor radio by Ultra Radio and Television Ltd. won the 1961 Duke of Edinburgh's prize for elegant design, awarded this week by the Council of Industrial Design. The winner was chosen for neatness in overall composition and careful proportioning of its polystyrene case and expanded aluminium grille. Runners-up included an adjustable spotlight fitting by Rotaflex, commended for its practical simplicity coupled with discriminative use of materials and finish. It was notable that selection of awards by this year's panel of judges was confined to articles of utility to the exclusion of any intended purely for decoration.



The "Lightplan Universal" spotlight fitting by Rotaflex, which received one of this year's awards by the Council of Industrial Design. Its satin anodised aluminium body is designed to take any make or size of lamp up to 150 W and is mounted on a 360° swivel. Besides the floor standard shown here, pendant and ceiling mountings are also available

News in Brief

Electric floor-warming and panel fires are to be incorporated in a £824,715 scheme for the erection of 253 new dwellings, including two 21-storey blocks, in Bermondsey, approved by the LCC Housing Committee.

Annual general meeting of the EIBA, followed by Council and Court meetings, will be held at the Electricity Council, Winsley St, W.1, on 7 July at 11.30 a.m.

Lord Hailsham, Minister for Science, is to open the International Plastics Exhibition and Convention on 21 June.

BICC have supplied 2,000 yd of p.v.c. insulated cable to the MEB for the lighting installation of signs, bollards and street lighting points on the 21-mile Ross spur of the Birmingham-Bristol motorway.

The National Research Development Corporation is discussing with industry what further research and development work is required on fuel cells. (Minister of Power in a written Parliamentary answer.)

Company Activities

THE bid bug is back! Horlicks intends to make a £4·1 million bid for Burt Boulton and Haywood, the timber merchants, paint and chemical makers; Transport Development Group offer £6·5 million for Beck and Pollitzer, transport and exhibition contractors; Associated British Foods of "Sunblest" bread and "Tip-Top" bakeries fame bids £1·3 million for London bakers, A. B. Hemmings, and some say the US controlled Prestige Group want Britain's Bulpitts (Swan Brand) electric kettle makers. All this and more enlivened proceedings considerably on the London Stock Exchange.

Most intriguing, of course, is the Bulpitts position. Not only did chairman Mr J. Newdegate deny there was any truth in the takeover rumours before last week's yearly meeting, but again at the actual meeting. On whispers, the 5s Ordinary shares had been bid up to a new 1961 "high" of 27s 6d against 24s 1½d at the start of the week's business. Said Mr Newdegate at the meeting: "In order that this rumour might be finally dismissed your board have asked me to state categorically that there are no such negotiations in progress. We have no reason to believe that any approach is imminent. If any approach is made we shall issue a statement to the shareholders at the earliest possible time." This was enough to bring the shares off the boil, back to 24s 4½d and then to 23s 9d by the week's close. Whether the matter rests at that remains to be seen, especially in view of the comments made at the meeting by London stockbroker Mr R. Zair. "There have been suggestions," he said, "that the family representatives (of Bulpitts) are very much against such a link-up, but in spite of this I should like to suggest that if any approach is made it is the board's duty as trustees for the shareholders to acquaint them of what is going on." There was no further comment from Mr Newdegate. Meanwhile, at 23s 9d the 5s Ordinary shares of Bulpitts yield £3 8s% on the 2.2 times covered 16½% dividend. There was disappointment with the shares earlier this year when the 1960 trading profit dropped to £710,881 after £801,368 in 1959. On the basis of a 30s a share bid it would cost a takeover merchant just under £8¼ million in cash to gather in all the equity of the company.

After Plessey made known that it had bought the Regentone radio and TV factory from Manchester's Lloyd's Packing Warehouses, Lloyd's Packing £1 Ordinary shares rose by 3s 6d to 38s and the reason is not difficult to discover in view of the chairman's comments last January. The effects of the Government's credit squeeze on their radio and television division, he revealed, quickly produced "deplorable conditions" which resulted in Lloyd's trading losses exceeding by £72,400 profits accrued by the radio and TV division in the early part of the year. Now the headache has been sold to Plessey. Even so, stock market men appear quite unperturbed at the prospect of Plessey taking this bigger step into radio and TV and Plessey's 10s Ordinary shares which opened the week at 59s 9d were no more than 3d back on the deal before closing the week at 59s 10½d.

Elsewhere in the electrical market, Birmingham Sound Reproducers advanced from 44s 1½d to 46s on the comments by chairman Dr D. M. McDonald that at the beginning of 1961 the group had never been in better shape and that they are pursuing extensions to the range of their products while improving existing models. International Computers and Tabulators after their recent bout of profit-taking regained 6s over the week at 106s 9d.—*From Our City Correspondent.*

Anderson, Boyes and Co.

Although net profit, after higher taxation charge, is down to £543,939 (*£598,599*), dividend is raised 1% to 10% by these mining, electrical and mechanical engineers. Demand for capital equipment accelerated towards the year-end and sales in the closing months were greater than anticipated, they state.

Barton and Sons

The conduit side of the group's activities is booming, and net profit of £587,971 for 1960 (*£545,217*) is a record for the fourth successive year. Dividend is raised by 2½% to 20% and shareholders will receive a one-for-four scrip issue. At Barton Conduits Ltd. the only limiting factor to production was the shortage of raw material and suitable operatives, the chairman states. The South African subsidiary, far from being upset by political uncertainty, lifted output by 25%. The structural steel picture, however, is not quite so rosy, with margins lower in the UK due to excess capacity. For the group, trading in the first three months of 1961 compares quite favourably with the corresponding period of 1960.

B.I.C.C.

The offer of £10 million 6½% debenture stock was more than five times oversubscribed. Allotment letters went out on Monday. After allotment in full of applications from Telcon loan stockholders, the remaining £9,201,045 of stock was allocated on the basis of in full for applications up to £100; £150 for applications for £200 to £500, with £100 allowed for non-preferential claims up to £500. All other applications were trimmed, allotments being on the basis that preferential applications get 18% and non-preferential 10% of the amounts applied for.

Brook Motors

Profit is up sharply for the first half of the current year at £577,497, compared with £366,222 in the previous corresponding period. Interim dividend stays at 5%.

Power Securities

A drop in net profit from £521,010 to £379,265 is attributed to extra costs incurred in order to finish the Selset reservoir on time. The Tees Valley and Cleveland Water Board were prepared to make an additional payment, but were prevented by the Ministry of Housing; the matter is now being considered by the company's advisers. Nevertheless, dividend is held at 15% and preference shares receive the maximum participating 3%, both payments being comfortably covered. The year was a difficult one, especially in civil construction, where tender prices were very keen, the chairman reports. Two developments on power schemes in Africa are that the investigation of the Niger River for the Electricity Corpn. of Nigeria is almost complete and design for the Hale hydro-electric scheme on the Pangani River in Tanganyika has been finalised. On prospects, the chairman says building in the UK should prove profitable this year and on the electrical side the group should obtain a reasonable amount of the work available.

Pressed Steel Co.

The gradual build-up of production at the new Swansea factory proceeded according to plan, and the finance subsidiary made a satisfactory start, the group chairman states in the 1960 report. Sales of domestic refrigerators were lower than in 1959, despite improved exports, but commercial refrigeration turnover continued to advance. Net profit of the parent, Pressed Steel, fell from £2,461,506 to £1,872,527.

Telephone Rentals Ltd.

It is hoped to maintain the present 15% dividend on capital which is to be increased by a one-for-five scrip issue, the directors state. But Mr W. S. Philcox, chairman, warns that progress may not be achieved immediately, but there is no evidence to suggest that any serious falling off in overall results need be anticipated. Some heavy increases must be expected in internal expenditure.

Relay Exchanges Ltd.

Although well satisfied with last year's increase in group trading profits from £3,580,000 to £4,240,000, Mr J. W. C. Robinson, the chairman, warns that television rental is becoming fiercely competitive. But trading results to date show a further improvement.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Loan for Subway

The Ontario provincial government is to provide a $60 million loan to Metropolitan Toronto to speed up construction of the east-west subway by two years. This announcement has come from the Premier, Mr L. Frost, only a few days after a formal application for the loan being made by the chairman of the subway system, Mr F. G. Gardiner. With the province putting up $9,000,000 this year, $16,000,000 in 1962, $20,000,000 in 1963 and $15,000,000 in 1964, the subway extension will be completed by 31 Dec., 1966, instead of the end of 1968, Mr Frost said. He regards the subway extension, which is expected to cost $200 million, as one of the most important construction projects ever undertaken in Ontario. "By speeding up the construction of the subway the province is acting consistently with its declared policy of promoting expansion and new development and fostering high levels of employment and income. The more rapid completion of the subway will provide a vital stimulus to economic activity not only in Metro, but in many other areas of the province and indeed in other parts of Canada," he said.

Saskatchewan's Results

The remarkable electrical progress in Saskatchewan over the past decade is outlined in the 1960 annual report of the Saskatchewan Power Corporation. Total installed generating capacity of all power plants in the provinces, for instance, was about 150 MW in 1950, and by 1960 had increased to over 660 MW, of which the Corporation's plants accounted for 550 MW, and whereas only some 4,500 farms were connected ten years ago, that figure has now risen to over 59,000. The smaller urban areas too have participated in the development, and from 435 communities with electricity service in 1950, the total has jumped to 940. Altogether, the Corporation supplied 186,843 consumers at the end of December last, output of the generating plants amounting to 1,234 million units, an increase of 15·6% over the 1959 figure. The Corporation operates six steam power stations, the latest of which, Boundary Dam of 132 MW capacity, provides approximately one-third of the total output. There are also eight internal combustion plants. Construction has already started on the first hydro-electric station in the Saskatchewan provincial system, at Squaw Rapids, which is to have an initial capacity of 201 MW, and work has been continued on the construction of the joint federal-provincial South Saskatchewan River power and irrigation project. The year covered by the report also saw the inauguration of the 230 kV transmission link with Manitoba.

Nuclear Increase?

Federal officials expect Ontario will decide to double the capacity of Canada's first full-size nuclear power station at Douglas Point even before the first unit is completed in mid-1964.

Mr J. L. Gray, president of Atomic Energy of Canada Ltd., told a special Commons research committee recently that it would take three to three and a half years to build the second unit once the decision was taken. It would bring the plant's power capacity to 400,000 kW. AEC is building the nuclear station, Candu, at the Lake Huron site, but the Hydro-Electric Power Commission of Ontario, which will operate the station, is committed to buying it after the plant has demonstrated its performance. The station is being built to accommodate a second reactor and the decision whether to build this second unit will have to be made by Ontario Hydro, but Mr Gray indicated that he had no doubt this would follow.

ALASKA

Yukon Survey

A major hydro-electric project in Alaska could result from a survey of the Yukon River which has just been made by a US survey team. An eight-man advisory board, comprising personnel from Alaska and the Western United States, has been set up to study the results of the survey and an economic analysis of both domestic and foreign markets. It is estimated that the Yukon River could produce more hydro-electric power than all the rest of Alaska. Ultimately three dams could be built across the river to provide an estimated aggregate output of 13,000,000 h.p. Three sites have been investigated by the survey team. Those at Kaltag and Woodchopper Creek could have a combined potential output of 6,700,000 h.p., but the site at Rampart Canyon is considered to have the most immediate promise. There, a dam 290 ft high would block the mouth of the Yukon flats and form an artificial lake of 10,000 sq miles. The controlled flow from this would generate 6,300,000 h.p., it is estimated. Alaska sorely needs more generating capacity to expand the important mineral industry, apart from expansion of the wood-working and pulp plants.

COLOMBIA

World Bank Loan

A loan equivalent to $22 million for expansion of hydro-electric installations supplying power to the Metropolitan area of Medellin has now been agreed by the World Bank. It is planned to install a further 138 MW of generating plant and extend transmission and distribution lines.

U.S.S.R.

Transport Plans

Future transport plans for Moscow, announced last week by the city authorities, will include a system of electric monorail cars which will carry up to 80% of the travelling public, it is stated. In the centre of the city trolley-buses have replaced trams and trolley-buses with trailers are to supersede the smaller vehicles. Apart from extension of bus routes, it is expected that length of underground railway lines will have been doubled by 1965.

CYPRUS

Loan Sought

Talks began in London last week on the request of Cyprus for a loan of approximately £7½ million towards the island's £10 million electricity development programme. The Finance Minister of Cyprus, Dr R. Theocharus, has arrived in Britain for the talks with Mr Duncan Sandys, Secretary of State for Commonwealth Relations. As we reported on 14 July, 1960, under the arrangement providing for the establishment of the new Republic in Cyprus, Britain has promised to make a loan towards the extension of the island's electricity system.

TANGANYIKA

Loan for H.E. Project

The Colonial Development Corporation are to provide a loan of up to £3 million to the Tanganyika Electric Supply Co. Ltd. towards the cost of constructing the Hale hydro-electric scheme on the Pangani River. The Tanganyika Government has agreed to provide up to £1,750,000 for the project and the supply company will also contribute from its own resources to the cost of its development. The new power station is to have an installed capacity of 21 MW, which will probably be made up of three sets. The station will be connected with the existing plant at Pangani Falls and a 132 kV transmission line will carry power to Dar-es-Salaam. A branch line will also run to Morogoro and Kilosa to provide the first public power supply to the Central Line sisal estates and townships. Balfour, Beatty and Co. are consultants and will build the project. It is hoped to begin construction work very shortly, as output will be needed from the station not later than the end of December, 1963, it is estimated.

GHANA

Volta Dam Contract

The first stage of the Volta River dam is to be built by the Italian firm of Impresit, who constructed the Kariba dam. Announcement of the award of the £16 million contract was made last week-end. Five firms, including a British and American consortium, tendered for the contract. This contract is for the construction of the main dam shoulder and the power house. Work is expected to begin within a very few weeks. The newly formed Volta River Authority are now recruiting chief officers, including a finance officer, chief engineer and chief electrical engineer.

S. AFRICA

Looking Ahead

If the present increasing demand for electricity continues in the Cape Town municipal area, negotiations for a further power station will require to be started within the next three years or so in order that it will be available for supply by 1970. This has been indicated by Mr. C. G. Downie, the city electrical engineer, in a municipal employees' magazine. The new Athlone station only recently started up with two 30 MW generating sets which are now undergoing acceptance tests. A third set is being installed and should be in commission before the end of this year. This will complete the first section of the new station. Contracts have already been let for the initial plant and building work of an extension ("A") which will eventually be equipped with three further sets of the same capacity and the full station of 180 MW should be available by 1967. As the Athlone station stands on a site of over 100 acres, it is considered there is ample room for a further station there, although, four years ago the City Council earmarked a site at Wynburg for a new station.

Pretoria Contract

In connection with Pretoria City Council's new Rooiwal power station under construction, a contract has now been let for the construction of the two cooling towers required for the first section comprising, two 60 MW English Electric turbo-alternators, with two Yarrow boilers. The contract amounts to £283,915 and has been let to Lewis Construction Co. (SA) Ltd. The station is programmed to go into commercial operation before the winter of 1963 and when finally completed with two more generating sets and boilers of similar capacity, the station will, it is claimed, be the biggest municipal coal-fired power station in the southern hemisphere.

INDIA

Meter Manufacture

A plant for manufacturing electric meters will be set up at Naroda, Ahmedabad, by the Electrical Instruments Manufacturing Co. Ltd, which is likely to enter the capital market in June with an equity issue of Rs25 lakhs in shares of Rs100 each. The company was formed to take over the Electrical Instruments Manufacturing Co., a firm engaged in the manufacture of switches. The company has been licensed to manufacture ironclad switches, boards, and single-phase and polyphase meters. It has entered into a technical collaboration agreement with Valmet Oy, of Finland and is planning to produce 60,000 house service meters and 24,000 polyphase meters a year.

Calcutta's Power Shortage

Rejecting a demand for an inquiry into the cause of the recent power shortage in Calcutta, the Union Minister for Irrigation and Power has said that there was no direct connection between the failure of the one set at Cossipore station of the Calcutta Electric Supply Corporation and two machines at the Durgapur thermal power station of the Damodar Valley Corporation. It seems that the two sets at Durgapur were under testing and commissioning by the German contracting firms, and had to be shut down and taken out for repairs following unstable flame conditions and leaks in the boiler tubing. Immediate repair work was initiated, one set being returned to the board within a few days, the other following shortly afterwards, but Calcutta is not expected to regain normal power supplies until the middle of June.

PAKISTAN

Grid Completion

The West Pakistan primary grid system is expected to be completed by the end of this month. The grid involved the construction of a total of about 630 miles of transmission lines. The Development Loan Fund of the United States is financing the construction of about 415 miles of the line. The remaining portion being financed by WAPDA out of its own resources. This portion relates to the Warsak-Kharian line.

POWER PLANNING IN NEW ZEALAND

NEW Zealand's electricity supply plans are discussed in a recent report (dated 1 March, 1961) of the "Planning Committee on Electric Power Development in New Zealand." Members of the committee are senior officers of electricity authorities and civil servants, and the committee reports to the Minister of Electricity.

The committee estimates that on the basis of present plans, there will be a surplus of generating capacity in both North and South Islands in all years up to 1966-67. However, for North Island, a dry year could cause an energy shortage in 1965-66 and thereafter.

Planning ahead to the period 1965-70 indicates that North Island will require an additional 95 MW station capable of generating 480,000,000 kWh each year. "In other words," says the report, "a new Whakamaru every year." South Island needs are less than half these figures, and are more than adequately provided for by the development capability of the Benmore station.

After discussion of possible power sources, the committee rules out base load steam stations (other than geothermal) while cheaper sources of fuel are available. This approach has been adopted even though it implies heavier demands on overseas funds than might otherwise be necessary. Against this background, no alternative is seen to the linking of the electrical systems of North and South Islands. The report underlines the urgency of completing North Island-South Island link by submarine cable, to which we have already referred.

Comparison of Estimated Peak Load and Estimated Installed Generating Capacity in New Zealand

Year	Prospective Peak Load	Estimated Installed Generating Capacity	Surplus or Deficiency
	MW	MW	MW
1965-66	1,994	2,488	+ 494
1966-67	2,123	2,668	+ 545
1967-68	2,257	2,668	+ 411
1968-69	2,397	2,836	+ 439
1969-70	2,543	2,886	+ 343

The table assumes:
North Island-South Island interconnection in service by April 1965.
Benmore—Three machines in service by April 1965. Full development by April 1966.
Aviemore—In service by April 1968.
Kopuriki—In service by April 1968.

On the financial side, it is estimated that power stations in South Island will cost about £75/kW based on normal load factors, while inter-island transmission will cost £27/kW. The resultant cost of £102/kW for power delivered to North Island compares "more than favourably" with the cost of prospective North Island development as it is known at present. Power generated at the Waitaki hydro station in South Island will be delivered at Wellington in North Island for about 0·44d/kWh.

As a result of its deliberations, the committee recommends construction of the h.v. d.c. link between North and South Islands to come into operation in 1965. Existing contracts for Benmore should be extended from two to six sets. The power station at Aviemore at the Waitaki River should be able to come into service in 1968. A station of about 200 MW capacity is reckoned possible at this site, which lies below Benmore. In the same year a power station at Kopuriki on the Rangitaiki River in North Island is suggested at 60 MW output.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

19 May—Belfast. Electrical installation in new intermediate school for boys, Brittons Parade.—See 11 May issue.

19 May—Braintree and Bocking U.D.C. Wiring, 24 existing houses, Cunnington Rd. —See 4 May issue.

19 May—Cardiff C.C. Electrical installation, on fixed-price basis, in sub-divisional police station, Canton.—See 11 May issue.

19 May—Chigwell U.D.C. 142 unit scheme comprising: Group "A" Concrete Utilities columns, Eleco lanterns and Venner time switches.—See 11 May issue.

19 May—Durham C.C. Supply: lamps.—See 4 May issue.

19 May—Durham C.C. 400 W colour-corrected mercury lighting on 30 ft steel columns at Lanchester Rd Ends roundabout and 200 W linear sodium lighting on 35 ft columns at Pity Me roundabout, comprising 27 units for A1 By-pass scheme.—See 4 May issue.

19 May—Glasgow C.C. Supply: electrical materials.—See 11 May issue.

19 May—Staffordshire C.C. Supply and installation of 12 car radio/telephones.—See 4 May issue.

20 May—Reigate B.C. Supply and erection of 19 Group "A" street lighting columns/equipment.—Advertised 4 May issue.

23 May—Bentley-with-Arksey U.D.C. Electrical installations in 38 bungalows, Queens Drive.—See 11 May issue.

23 May—Londonderry C.C. Electrical installation in Straidarran New County Primary School.—See 11 May issue.

24 May—Cheltenham B.C. (1) Supply of 64 60 W and 42 45 W sodium lanterns/gear; (2) supply/erection of 106 steel columns/fitting/wiring.—Advertised 27 April issue.

24 May—Eastleigh B.C. Supply and erection of 78 Group "A" 140 W sodium units and 267 Group "B" 60 W sodium units. Borough Engineer and Surveyor, E. J. Tapley, Town Hall. Deposit £2 2s.

24 May—Fermanagh C.C. Electrical work in Mullagh Primary School extensions and alterations.—See 4 May issue.

25 May—Bridport B.C. 51 Group "B" Stewarts and Lloyds columns/brackets and 125 W lamps at Barracks St and St. Andrews Rd.—See 4 May issue.

25 May—Lewisham B.C. Street lighting conversion schemes: (1) 190 Group "A" to 140 W sodium; (2) 242 to 200 W linear sodium; (3) Group "B" to 60 W sodium; (4) erection of 81 Group "A" steel columns complete with linear 200 W sodium lanterns, etc. Borough Engineer, Town Hall, S.E.6.

26 May—Cardiff C.C. Electrical installation, on fixed-price basis, in Technical High School.—See 11 May issue.

26 May—Londonderry C.C. Electrical installation in Draperstown School meals kitchen/dining hall.—See 11 May issue.

26 May—Middlesbrough C.B.C. Tender 53: supply of lamps for year. Borough Engineer, Municipal Bldgs.

26 May—Plymouth C.C. Rewiring at public secondary boys' and girls' schools, Coburg St.—Advertised 11 May issue.

27 May—Blackburn C.B.C. (3) Supply of instruments and accessories for Electrical Eng. Dept. of Municipal Technical College. Chief Education Officer, Library St.

27 May—Surrey C.C. Installation of 18 tubular steel columns and 22 400 W mercury lanterns at Glanty roundabout, Egham. —See 11 May issue.

29 May—Barrow-in-Furness C.B.C. Supply and erection of screening plant, motors and control gear for Sandgate pumping station reconstruction.—See 4 May issue.

29 May—Breconshire C.C. Electrical installation in four-stream secondary modern school, Brecon. Applications to Clerk: C. M. S. Wells, County Hall, Brecon, by above date. Deposit £2 2s. N.I.C. firms only.

29 May—Coulsdon and Purley U.D.C. Provision of 182 Stanton Group "A" concrete columns; provision and fixing of 60 W and 140 W sodium lamps and G.E.C. lanterns; plus removal of existing street lighting.—Advertised 11 May issue.

29 May—Larne B.C. Electrical installation in Municipal Offices. Details from consulting engineers, A. K. McAuslan & Ptnrs, 16 Bedford St, Belfast 2. Deposit £3 3s.

29 May—Manchester C.C. Supply of two main generators 45 kW 220 V d.c. for sludge vessel *Mancunian* conversion.—See 4 May issue.

29 May—Manchester C.C. Electrical installation in Aged Persons' Home, Felskirk Rd, Wythenshawe.—See 4 May issue.

29 May—Sunderland C.B.C. Electrical installation in public abattoir meat market, Fulwell.—Advertised 11 May issue.

29 May—West Riding C.C. Rewiring and fire alarm installation, Children's Home, Bramham House.—See 4 May issue.

30 May—Ealing B.C. (a) Supply of 3,600 sodium lanterns/lamps/gear; (b) supply of 1,500 brackets and 500 control gear boxes. —Advertised 11 May issue.

30 May—Kirkham U.D.C. Supply, erection and installation of 14 Group "B" concrete columns and 80 W m.v. lighting/gear/wiring, Freckleton Rd.—See 27 April issue.

1 June—Kingston upon Hull C.C. Switching equipment for new central automatic telephone exchange.—See 11 April issue.

1 June—St. Albans C.C. Supply of Group "A" concrete lighting columns for conversion scheme. City Engineer and Surveyor, 16 St. Peter's St.

2 June—E.B. for N. Ireland. Supply and erection of circulation water pipework and valves at Coolkeeragh.—See 4 May issue.

3 June—Carrickfergus B.C. Supply and erection of 83 4 ft 40 W fluorescent lanterns and 129 2 by 2 ft fluorescent lanterns. Borough Surveyor, Town Hall.

5 June—Aireborough U.D.C. (1) Supply/erection of 59 Class "B" columns/brackets and fitting/wiring of lanterns; (2) supply of mercury vapour lanterns/gear.—Advertised 4 May issue.

5 June—Brighton C.B.C. Electrical installation on fixed price basis, Teachers' Training College, 9-10 Percival Terr. Borough Surveyor, Engineer and Planning Officer, 26-30 King's Rd. Deposit £1 1s.

5 June—Hereford T.C. Provision of 187 Group "B" lighting units, comprising 29 sodium with new columns with the remaining as tungsten units, and include erection of new columns and conversion and resiting of existing gas columns. City Surveyor, F. Margerison, Town Hall.—Advertised in this issue.

5 June—Northern Ireland. Applications for inclusion in approved list of electrical contractors to Secretary, Ministry of Commerce, Room 30B, Chichester Hse, Chichester St, Belfast 1, by above date.

6 June—Dartford Tunnel. (4) Electrical distribution, lighting, tunnel services and pumping installations for M. of Transport. —See 27 April issue.

7 June—Wallasey C.B.C. Supply of 52 Group "B" concrete columns and post top lanterns. Borough Engineer and Surveyor, Town Hall.

9 June—Hereford T.C. Wiring of 147 houses and 12 bungalows on Newton Farm Five estate. City Architect, Town Hall. Deposit £1 1s.—Advertised in this issue.

12 June—Limerick T.C. Supply of sewage pumps, motors, control panels and switchgear, for Rosbrien Pumping Station. City Engineer, Town Hall.

13 June—West Riding C.C. (4) Rewiring of Westerton J.M. and I. School. Details from Divisional Architect, Bishopgarth, Westfield Rd, Wakefield. N.I.C. roll number required.

19 June—E.B. for N. Ireland. Specification NI 1633. Supply and erection one 4 MVA 11·8/3·5 kV unit transformer for Coolkeeragh.—See 20 April issue.

3 July—West Riding C.C. Conversion of Thorne swing bridge on A614 to power operation.—See 11 May issue.

No date stated—Larne B.C. Electrical installation in Municipal Offices.—See 11 May issue.

No date stated—Swinton and Pendlebury B.C. Electrical installations in 94 dwellings. —See 27 April issue.

No date stated—Ayr C.C. Supply of: (1) concrete columns; (2) electrical equipment; (3) 140 W so./h. lanterns; and (4) erection, for Kiwinning By-pass roundabout lighting. Water and Drainage Engineer, County Bldgs, Ayr.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 116 queries answered this week

"Duchess" domestic hood type hair-dryer—makers of? T.E.—Mitcham Manufacturing Co. Ltd., Mitcham Wks, Winchelsea Rd, Harlesden, N.W.10.

"Solar Weld Languepin" spark erosion machine—address for? L.S.M.—Solar Weld Languepin Ltd., c/o Burnley Aircraft Products Ltd., Fulledge Wks, Holmes St, Burnley, Lancs.

"Halbur" blankets—makers of? L.E.B. —Electro-Medical Blankets Ltd., Nugent St, Leicester.

"Trico" car fans—makers of? G.S.—Trico-Folberth Ltd., Gt. West Rd, Brentford, Middx.

"Thorens" battery shavers—agents for? C.L.—Presenta Ltd., 49 Tamworth Rd, Hertford.

"Claco" domestic appliances—makers of? E.E.B.—Charles Lathe and Co. Ltd., Upper Church La, Tipton, Staffs.

"Samovar" coffee percolators—makers of? W.K.—Wm. May and Son (London) Ltd., Dominant Wks, Elthorne Rd, N.19.

"Widney-Dorlec" cabinet systems—makers of? H.S.—Hallam, Sleigh and Cheston Ltd., Widney Wks, Bagot St, Birmingham 4.

FURTHER ANSWER

"Moulinex" coffee grinders—address for? E.D.—Andrews Houseware Mfrs. Ltd., 137 Kirkdale, Sydenham, S.E.26.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

27 May—India. 600 mile 37/-132 a.c.s.r. conductor, midspan joints, hydraulic compressors for joints, come-along clamps, dynamometers and vibration clamps for 132 kV single-circuit line. Director, Central Stores Purchase Dept., Government of Andhra Pradesh, Hyderabad. B.o.T. (ESB/15215/61).*

29 May—India. H.T. insulators and hardware. Controller of Stores, Maharashtra S.E.B., Mercantile Bank Bldgs, Fort, Bombay 1. B.o.T. (ESB/15237/61).*

30 May—India. All-aluminium conductors and a.c.s.r. accessories. Controller of Stores, Maharashtra S.E.B., Mercantile Bank Bldgs, Fort, Bombay 1. B.o.T. (ESB/15238/61).*

7 June—Australia. Nine 50 kVA 22 kV/230 V transformers. Secretary, Victorian Railways, Melbourne C.1. B.o.T. (ESB/15483/61).*

14 June—Malaya. One 30-ton and one 10-ton travelling crane for Johore Bahau Power Station. Contract EE.1737/6, details from Crown Agents, 4 Millbank, S.W.1.

15 June—India. 30,000 s.-ph., h.s. meters. Stores Purchase Officer II, Rajasthan S.E.B., Jaipur. B.o.T. (ESB/15278/61).*

26 June—Australia. Four 15 MVA 132/33-11 kV transformers. Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/15856/61).*

26 June—Sudan. Five mile two 7/·036 3·3 kV conductors and two speech quads p.v.c. insulated, s.w.a. and p.v.c. cable. Controller of Stores and Workshops, Dept. of Posts and Telegraphs, Light Industrial Area, Khartoum. B.o.T. (ESB/15438/61).*

27 June—Canada. 480 V distribution and motor control centres for Squaw Rapids H.E. scheme. Saskatchewan Power Corpn., 1739, Cornwall St, Regina. B.o.T. (ESB/15851/61).*

3 July—Pakistan. Two 20 kW diesel generators complete with switchgear. Chief Controller of Stores, Eastern Railway, Pahartali, Chittagong. B.o.T. (ESB/15273/61).*

10 July—Ghana. 4,600 fluorescent fittings, complete with tubes. Secretary, Ghana Supply Commission, P.O. Box M.35, Accra.—Advertised in this issue.

10 July—Trinidad and Tobago. (1) Conductors s.c.a.; (2) discharge lamps. Purchasing Officer, Electricity Commission, P.O. Box 121, Port of Spain.—Advertised in this issue.

21 Aug.—Australia. Two 350 MW semi-outdoor type reheat boilers and ancillary plant for Munmorah Power Station. Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/15465/61).*

No date stated—Sudan. 340 street lighting lanterns of the enclosed type and 325 56 in. ceiling fans. Gezira Board Representative, Castle Chmbrs, Castle St, Liverpool 2.

Gazette Announcements

COMPANIES ACTS

Austin Fenwick Ltd. Meetings of creditors and contributories to be held at Methodist Church Hall, Lonsdale St, Stoke-on-Trent, on 18 May, at 11 a.m. and 11.30 a.m., respectively.

Consul Washer and Vacuum Co. Ltd. Resolution for voluntarily winding-up passed at extraordinary general meeting on 27 April. Creditors to send details to liquidator R. D. Collingwood, 19 Victoria St, Blackburn, by 15 June.

Cradley Electrical Maintenance Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 5 June. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2, by 4 p.m. 2 June.

Overseas Electrical Supplies Ltd. General meeting to be held at Jacey Hse, Lansdowne, Bournemouth, on 28 June, at 12 noon, for the purpose of having an account of the winding-up laid before members.

Plow Water Heaters Ltd. Winding-up order dated 3 May.

Ristona Products Ltd. Mr. P. Cordwell, 93 Queen St, Sheffield 1, appointed liquidator at extraordinary general meeting on 25 April for the purpose of voluntarily winding-up.

Amorduct Cable Co. Ltd. and **Long Eaton Cable Co. Ltd.** Meetings of creditors to be held at Christchurch United Clubs, Kennington Oval, S.E.11, on 25 May, at 3 p.m.

Markwells (Electrical Supplies) Ltd. Meeting of creditors to be held at Tudor Hse, 58 King St, Maidenhead, Berks, on 31 May, at 11.30 a.m.

BANKRUPTCY ACTS

Receiving Orders

Birkenhead. A. Craig, electrical dealer, formerly carrying on business at 13 North Drive, Wallasey. Receiving order dated 3 May.

St. Albans. F. W. Poole, electrical appliance dealer, formerly carrying on business at 393a High St, Watford. Receiving order dated 4 May.

Public Examinations

Derby. G. C. Ross, electrical retailer, formerly carrying on business as Midland Electrical Supplies at 80 Green La. Public examination: 10 a.m., 19 July, at Official Receiver's Office, at 20 St. Peter's Church Yd, Derby.

Stockton-on-Tees. J. J. Burke, plumber and electrician, carrying on business at 44 Whitby St, West Hartlepool. Public examination: 11.15 a.m., 9 June, at Court Hse, 4 Bridge Rd, Stockton-on-Tees.

Appointment of Trustee

Liverpool. C. E. Badger, appliance dealer, carrying on business at 211 Gt. Homer St, Liverpool 5. Mr R. P. Booth, 5 Rumford Pl, Chapel St, Liverpool 3, appointed trustee as from 4 May.

Release of Trustees

Southampton. J. R. Woods, domestic appliance retailer, formerly carrying on business as Homelectrics, at 3 St. Mary's Rd. Trustee: A. H. Holer, 16 Westwood Rd, Southampton, released as from 2 May.

Truro and Falmouth. G. B. Solomon, radio and electrical dealer, carrying on business as St. Columb Radio, at 57 Fore St, St. Columb. Trustee: J. E. Ellis, 5 Marlborough Rd, Plymouth, released as from 24 April.

High Court of Justice. A. C. Sewell, electrical contractor, carrying on business at 56 White Lion St, N.1. Trustee: A. A. Walter, Bankruptcy Bldgs, Carey St, W.C.2, released as from 28 March.

Intended Dividend

Barnstaple. G. H. Cornwell, electrical retailer, carrying on business as "Tele-Speed," at 21 Rockmount, Pitt La, Bideford. Last day for receiving proofs 23 May. Trustee: J. E. Ellis, Marlborough Hse, 5 Marlborough Rd, Plymouth.

CONTRACTS PLACED

Bradford C.C. Allerton housing estate electrical work, J. Carter and Sons (Bradford) Ltd., £7,414. Recommended.

Felling U.D.C. Electrical installation in new swimming baths, North of England Eng. and Electrical Co. Ltd., £8,916 7s 6d.

London C.C. Electrical installation improvements at Hutton Residential School, Powis Electrical Co. Ltd., £6,782.

Maidstone B.C. 1961/2 street lighting improvement programme, A.E.I. Lamp and Lighting, £24,873. Recommended.

Newcastle Hospital Board. Electrical installation in nurses' training school at Bishop Auckland General Hospital, Cox-Walkers Ltd., £1,169 17s.

Peterborough C.C. Electrical installations in 172 dwellings, M. F. Hansen, £4,298. Recommended.

Saltburn and Marske U.D.C. Electrical installations in 20 flats, F. W. Condell.

Stoke-on-Trent C.C. Electrical installations in 52 dwellings, Longton Hall Rd, Barker and Co., £1,226. Recommended.

TRADE NOTES

BEAMA Contract Price Adjustment Formulae. *For Electrical Machinery and Equipment.* For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 May, 1961, shall be deemed to be 213s 6d; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 12 May, 1961, is 117·4* (182·1*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour as at 12 May, 1961, shall be deemed to be 213s 6d; (*b*) "Cost of Materials"—the index figure for materials used in the Mechanical Engineering Industry at 12 May, 1961, is 127·7* (191·9*). "Blast Furnace and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)," 189·3. Other Steel Goods excluding tubes (1958 S.I.C. ref. 311/2), 129·0. The price of brass condenser tubes ¾ in. o/d 18 s.w.g. on 12 May, 1961, is 4s 2½d per lb. *Provisional figure.

The figures in parentheses shown above relate to earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

New plant. Electrothermal Engineering Ltd. announce that their new precision wire wound Precistor unit is now in operation at their Southend factory.

Expansion. International Computers and Tabulators Ltd. has taken over the former premises of Glover and Main Ltd. with a frontage on Thornton Rd, Croydon, providing 100,000 sq ft of manufacturing space.

Extensions to treble the capacity of the High Wycombe factory of Charles Colston Ltd. have now been completed, and offices have been transferred from central London to there. As from this week the central administration, sales and general accounting, design and developments production, despatch and southern branch sales division will be at Wellington Rd, High Wycombe. Telephone: High Wycombe 4321.

J. Walton (Electrical) Ltd., electrical and radio wholesalers, have this week opened a trade counter and central stores at Brunswick Mill, Bradford Rd, Manchester 10.

Plans of the Plessey Co. Ltd. to extend two of its Towcester plants have now reached an advanced stage.

Annual holiday. The Elverton Street Wks of Holophane Ltd. will be closed for the annual holiday from 17 June to 3 July. The offices will not be closed.

Computers. Honeywell Controls Ltd. have formed an electronic data processing division to make and service all-purpose computers.

BUSINESS PROSPECTS

Accrington. Proposed: bank and offices, Whalley Rd, for Lloyds Bank Ltd., Lombard St, E.C.3.

Alnwick. Stanley Miller Ltd., North St, Newcastle, contractors for grammar school for Convent of Mercy.

Barnsley C.B.C. Tender: 100 traditional dwellings, St. Helen's site. Engineer.

Barnstaple B.C. Tender: 42 dwellings, Forches estate. Surveyor.

Barton-on-Sea. Three-, six- and ten-storey flats, junction of Becton and Barton Common Lns, proposed by C. H. Elsom and Ptnrs.

Bath. Proposed laboratory, workshop block, general purposes block and lecture theatre for Technical College to cost £383,250.

Belford R.D.C. Graham and Son, Westcroft Rd, Newcastle, awarded contract for new council offices.

Berks. C.C. propose £400,000 S.E. Berks College of Further Education, Bracknell High St.

Birmingham. Pearl Assurance Co. Ltd., High Holborn, W.C.1, propose eight-storey shops/offices, City Centre.

Blackburn. Factory extensions and office block, Atlas Paper Wks, New River St, proposed by J. S. Duxbury and Sons Ltd.

Bolsover. New factory, Carr Vale, planned by Walker and Hall Ltd., Howard St, Sheffield 1.

Boston. Sheffield Regional Hospital Board, Old Fulwood Rd, Sheffield, propose £2,832,360 new general hospital, Sibsey Rd.

Brentford. K. C. Saunders, 341 Finchley Rd, N.W.3, architect for proposed 12-storey block, Gt. West Rd. Jantzen propose office block, Gt. West Rd. Architects: Newman, Levinson and Ptnrs., Mansfield St, W.1.

Brentwood U.D.C. Tender: 47 dwellings, Hutton Dr, Hutton. Architects: L. D. Tomlinson and Ptnrs, Romford.

Brighton. Southdown Motor Services Ltd., Steine St, propose office block, Freshfield Rd. A. Bailey, Gray's Inn Sq, W.C.1, architect for proposed £75,000 office block for National Friendly Deposit Society Ltd.

Bristol. McKay Securities Ltd. plan seven-storey offices, Baldwin St. Architects: Alec French and Ptnrs., St. Augustine's Parade.

Cardiff C.C. Tender: 40 houses, Pen-Yr-Heol estate. City Architect.

Carlisle. N. M. Phillips, Grosvenor Hse, Warwick Sq, architect for proposed St. Bede's R.C. school.

Chatham. Eight-storey hotel/flats, Station Hotel site, planned by Abbey Homesteads Ltd., c/o J. D. Walter and Son Ltd., estate agents, New Rd.

Chelmsford. Proposed: Nine-storey offices, High St. Architect: N. S. Morrow, St. Peter's Court, N.W.4.

Chester. Burroughs Adding Machines Ltd., Oxford St, W.1, propose new factory, Sealand trading estate.

Christchurch. Brandon-Jones, Ashton and Broadbent, Redlington Rd, Hampstead, N.W.3, architects for proposed county mixed grammar school.

Dagenham. Standard Plywood Mfg. Co. Ltd., Taplow St, N.1, propose new factory.

Darwen. I.C.I. Ltd. propose £200,000 modernisation of Britannia Mill.

Derby. Trollope and Colls Ltd., Noble St, E.C.2, contractors for proposed Rolls-Royce three-storey engineering and main office buildings, Sinfin; Hammerson Group, Park La, W.1, propose redevelopment of City Centre

Dromore. Tender: 29 dwellings, Rampart St. General manager, Northern Ireland Housing Trust, Hope St, Belfast 12.

Durham. R.D.C. propose 181 houses in seven areas during current year. Architect.

Eastleigh. Factory/offices, Woodside Rd, proposed by Hill Construction Co. (Engs.) Ltd.

Enfield. Thos. Morson and Son Ltd., Summerfield Wks, Wharf Rd, propose chemical milling building; I.F.F. (Gt. Britain) Ltd. plan new factory, Crown Rd. Architects: Edward D. Mills and Ptnrs., Richmond Bldgs, W.1.

Fleet. Compendium Properties Ltd. propose shops/flats, Odeon Cinema site. Architect: R. J. Hubbard, Wigmore St, W.1.

Gateshead. Millerdale Properties Ltd., Dean St, Newcastle, propose £1 million five-acre shopping centre, High St, West St areas; T.C. propose shop premises, Leam La estate. Engineer.

Glasgow C.C. Tender: primary school, Hutchison Sq. City Architect, Trongate, C.1.

Grimsby. Taylor and Coulbeck Ltd., Hawthorne Rd, Cleethorpes, contractors for proposed Findus Ltd. new factory.

Halifax. John Mackintosh and Sons Ltd. propose £1 million extensions.

Hampshire. Wessex Regional Hospital Board, Winchester, propose Coldeast Hospital development to cost £592,000 and development of Tatchbury Mount Hospital for 493 beds.

Hebburn. D. Brown, Lambton Rd, Newcastle, architect for proposed R.C. church and presbytery, Mill La.

Isle of Wight. F. G. Broadbent and Ptnrs., Manchester Sq, W.1, architects for proposed £158,000 R.C. secondary school, Priory Farm.

Jarrow. Supermarket, Bede Burn Rd, proposed for London and Newcastle Stores Ltd., St. James St, Newcastle.

Kendal. £68,450 operating theatre and boiler house proposed by Manchester Regional Hospital Board for County Hospital.

Leeds C.C. Tender: 121 traditional dwellings, Greenside. City Architect; Tender: alterations of factory premises, Bell Vue Rd, for Mobile Police H.Q. Director of Works.

Liverpool. The Metal Box Co., Baker St, W.1, propose eight-acre development, Evans Rd, Speke.

London. M. Shapiro and Sons Ltd., Gossett St, E.2, propose factory, The Oval. £100,000 rebuilding plans for St. Saviour's and St. Olave's School, New Kent Rd; architect: J. E. K. Harrison, Eagle Hse, High St, S.W.19. Five-storey office block and post office at Commercial Rd, E.1, planned by Covell and Matthews Ltd., Sackville St, W.1. Multi-storey shops/offices, Streatham High St, planned by Huckle and Durkin, Queen Anne St, W.1. Offices/flats, Streatham High Rd, planned by Sir John Brown, A. E. Henson and Ptnrs., Sloane St, S.W.1. Five-storey block, Newman St, W.1, planned by Newman Levinson and Ptnrs., Mansfield St, W.1. Shops/offices/flats, Tavistock Pl and Marchmont St, W.C.1, proposed by R. Seifert and Ptnrs., Red Lion Sq, W.C.1. Office block on site of Gorringe's Hotel, Warwick Row, S.W.1, proposed by City of London Real Estate Property Co.; quantity surveyor: E. Howard and Ptnrs., Piccadilly, W.1.

Luton. C. E. and R. C. Wilkinson, Williamson St, propose re-location of factory premises at St. Mary's Rd.

Manchester. Donald Shearer and Co. Ltd., woollen merchants, Lower Mosley St, propose seven-acre development on Lower Mosley St site.

Midlothian C.C. Tender: several works, additions to East Calder Junior Secondary School. County Architect, Palmerston Pl, Edinburgh.

Middlesbrough. Tender: Aged persons' hostel, Marton Rd, Beechwood. Engineer. Metropolitan Railways Surplus Land Co., Harrow Rd, W.10, propose seven-storey office block/underground car park, Linthorpe Mews area.

Middlesex. Planned: rebuilding of Orange Hill secondary schools, Hendon, at cost of £202,565. County Architect.

Morecambe. Storey Bros. and Co., White Cross Mills, Lancaster, propose new laboratory and warehouse extensions.

Newcastle. Proposed: development for Dryburn and Darlington Memorial Hospitals for Newcastle Regional Hospital Board. Chief Architect, Benfield Rd; Stanley Miller Ltd., North St, contractors for new science/maths. block, Eldon Pl, for King's College.

New Milton. Proposed: 256 flats, 20 dwellings, Milton Nurseries, Ashley Rd, for H. G. Stevenson; 195 flats, three shops, Fernhill Manor estate, proposed by H. H. Drew and Son Ltd.

Northumberland C.C. Proposed: £220,000 new fire brigade H.Q., Morpeth; £80,000 old people's homes, Ashington and Berwick; £100,000 additions to Kirkley Hall Farm Inst. County Architect.

Nuneaton. Car Panels (Nuneaton) Ltd. propose factory extensions, King Edward's Rd; B.C. Tender: 48 flats, Camp Hill estate. H. N. Jepson and Ptnrs., Midland Bank Chmbrs, Newdigate Pl, architects.

Peterborough C.C. B. Stokeley Ltd., Eastfield Rd, awarded £209,729 contract for third and fourth stages of new technical college.

Reading. Gillette Safety Razor Co. propose light industrial factory, Basingstoke Rd. Architects: Dodge and Reid, High St, Brentford.

Rotherham T.C. Frank Haslam, Milan and Co. Ltd., Doncaster, awarded £294,555 contract for housing development, Kimberworth Pk estate; Kenyon, Son and Craven Ltd. plan factory extensions, Eastwood trading estate.

Salford. Offices/warehouse, Hope St, Muslin St, planned by Mantell, Brereton Ltd., Oldfield Rd, Manchester 5. C.C. Tender: two-bay sub fire station, Bury New Rd. Tender: 33 flats in three-storey blocks, Medway Close, Eccles Old Rd. City Engineer.

Smethwick. Planned: new production building, Brasshouse La, for District Iron and Steel Co. Ltd., Brasshouse La.

South Shields C.B.C. Tender: 54 old people's bungalows/communal hall/ancillary unit, Wenlock Rd, Simonside. Engineer; Martins Bank, Laygate, to be re-built by Milton Swailes Ltd., Imeary St.

Wallasey. Cadbury Bros. Ltd. propose further extensions to amenity block, Pasture Rd.

Walsall C.B.C. Tender: 80 dwellings, Darlaston Rd; 12 houses, Mulberry Pl, Bloxwich. Engineer.

Warlingham. Marshall-Andrew and Co. Ltd., Broadway, S.W.1, contractors for £100,000 Givauden and Co. Ltd. chemical factory, Whyteleafe.

Washington. F. B. Hindmarsh and Ptnrs., Northumberland St, Newcastle, propose industrial developments, Usworth Station Rd.

Watford. N.W. Metropolitan Regional Hospital Board, Eastbourne Terr, W.2, propose redevelopment of Shrodells Hospital including staff residential accommodation.

Wembley. Chesterfield Properties Ltd., Chesterfield St, W.1, propose new premises costing £300,000, High Rd.

West Bromwich. Planned: seven shops with showrooms/offices/stores, Gt. Bridge, for Baratham Ltd. Architects: John F. Phillips and Associates, Birmingham Rd, Walsall.

West Hartlepool. Cairns and Byles, Osborne Rd, Newcastle, consulting engineers for renewal of electrical installation, Oxford St Junior School.

Westport. Tender: new factory for Westport Textiles Ltd. Architects: Padraig Mulcahy, Northbrook Rd, Leeson Pk, Dublin.

Whitstable. Kirkstall Holdings Ltd. propose shops/maisonnettes to cost £350,000. High St, Middle Wall. S. Lazarus and Ptnrs., New Cavendish St, W.1.

Winchester. Three-storey admin. building, costing £200,000, proposed at Staple Gdns by Southern Counties Agricultural Trading Society Ltd., Northgate Hse, Winchester. Contractors: Henry Boot and Sons (Southern) Ltd., The Boltons, S.W.10.

Withernsea U.D.C Tender: houses, bungalows, Clovelly housing estate. Surveyor.

Wolverhampton C.B.C. Tender: 30 dwellings, Coronation Rd. Engineer.

Wortley R.D.C. Tender: four blocks of flats, nine blocks of bungalows, Colley Rd, Ecclesfield. Engineer.

Company Meeting

Enfield Rolling Mills

A Year of High Activity

Difficult Conditions

THE EARL OF VERULAM'S REVIEW

THE 37th annual general meeting of Enfield Rolling Mills, Ltd., was held on 17th May at the registered office, Millmarsh Lane, Brimsdown, Enfield, The Rt. Hon. The Earl of Verulam, chairman and managing director, presiding.

The following is his statement circulated with the report and accounts for the year ended 31st December, 1960:—

THE BOARD

Last October my brother, who had been a director for 17 years and Chairman since 1950, died at the age of 50. His first link with this company was in 1933, the year after the company was made public, when he started Enfield Zinc Products. Thereafter, for many years, he was Managing Director of Enfield Cables next door. An authority on management problems, scholar, linguist, traveller, humanist, he was a man of great humility—with an immense personal following in the factories at Brimsdown.

The Board appointed me in succession as Chairman. As I continue as Managing Director, a number of alterations of responsibility were made to give a proper balance on the Board. Amongst these, Mr W. R. B. Foster has become Vice-Chairman, Mr B. Powell, who remains on the Board, has relinquished his position as Secretary, and Mr R. J. Smith has been appointed in his place. Mr W. W. Kee has been invited to join the Board from the 1st January, 1961. He has been with the company since 1941, latterly as Managing Director of Enfield Rolling Mills (Aluminium) Limited (ERMAL). He is also Managing Director of Alcan Enfield Alloys Limited (Alenoy).

PROFIT COMPARISON

Two years ago my predecessor stressed that a check to our rate of progress seemed inevitable. In the event the check has become apparent only in 1960. We lost money, too, on our stocks of metal during the year—as we warned that we expected to do last year.

Copper was £27 per ton cheaper at the end of 1960 than at the beginning. When this occurs at the same time that a backwardation persists on the London Metal Exchange, a loss on stocks is inevitable whether they are hedged on the Exchange or not. Our kind of business ought, as was recommended in 1955 by the Royal Commission on the Taxation of Profits and Income, to be able to value our irreducible basic stock of metal at fixed prices; this would make our figures more easily comparable from year to year.

SELLING PRICES

The year was one of high activity during which we held our selling prices down—hoping to offset cost increases by the larger volume. Many of our products are the raw materials for other trades which are meeting keen price competition in export markets. However, we have had, reluctantly, to increase some prices this year.

DOCK STRIKE

Our supplies of metal come to us through the Port of London and most of our exports go out through it too. This direct link by water with overseas suppliers and customers can be a great advantage, but we have long become accustomed to Port delays and troubles. As a result we carry heavier stocks and consequently use more money and run greater risks than we would like.

The unofficial strike of tally clerks from 20th September to 17th October was sufficiently serious to merit special reference. Incoming ships were diverted all round the Continent, with the result that not only did we have to pay for our metal long before we received it but we also incurred additional transshipment and forwarding charges. Export orders which we had obtained in the face of fierce international competition were delayed. These delays are not forgotten by the buyers when follow-on orders are being negotiated, so work is permanently lost, not only to our own workpeople but also to the Port of London itself.

The indirect costs, such as loss of overseas business, cannot be measured. The extra direct costs incurred by our company alone during the dock strike were over £40,000. We were unable to pass on any of this to our customers.

TRADING EXPERIENCE

I will preface this part of the report by reminding shareholders that it is just over two and a half years since we were faced with the loss, overnight, of that basic tonnage around which the whole company had been built. We had either to contract and face a capital loss on our plant as well as prune our staff and activities severely or else expand and face teething troubles and losses for a period. The decision to extend our range into the cable field was right and the company even today, despite the cable trade's troubles, is in a much stronger position than it would have been had we chosen the alternative. The full benefits of such radical changes take long to materialise; it will be at least another two years before the financial effects become fully apparent of all that has been done and of further moves under consideration. The major Brimsdown departments, copper refining, rolling, drawing, copper and brass sheets and zinc mill, had a very good year.

Barker and Allen in Birmingham had a very successful year, fully up to the company's previous performance; this year 12 months' figures are included in the Accounts.

W. E. Martin also had a very good year's trading, as did Refrigeration Appliances.

Our expectation, mentioned last year, that Enfield Cables in its restricted field would operate profitably was fulfilled.

We were most disappointed with the results shown by two of our subsidiaries—Aston Chain and Hook through troubles on their new brass mill and Watliff through a combination of low prices and credit squeeze problems. We are determined to put these right.

During the year a number of major extensions of capacity were carried a stage further, notably at Barker and Allen and in the Sheet Mill, Zinc Mill, Foundry, Encon and Engineering Departments at Brimsdown.

Our total manufacturing profit in 1960 was greater than in 1959.

ASSOCIATED COMPANIES

Your company now has substantial investments in two associated companies, Enfield-Standard Power Cables Limited and Alcan Enfield Alloys Limited. Although the trading results of these two companies are not reflected in the Accounts before you, I should, perhaps, comment briefly upon them.

ENFIELD-STANDARD POWER CABLES LIMITED

This company traded for a substantial loss during the year in common with the power cable element of other cable-making groups.

Enough has been said elsewhere for shareholders to know that the price war which started on 1st May, 1959, resulted in a general lowering of selling prices to below cost. Although most current prices are back to a proper competitive level, long-term contracts mean that it will be the middle of 1961 before the great majority of invoicings are at current selling levels. This salutary lesson of how easy it is to destroy and how long it takes to rebuild has not been lost upon the trade as a whole.

Enfield-Standard Power Cables has more than maintained the volume of its two parent companies and the technical integration and balancing of the two undertakings is being successfully achieved.

ALENOY

This particular link with Aluminium Limited became necessary because of the progressive attack of the world's virgin aluminium producers upon the U.K. market. Unlike the copper industry in the U.K., which is independent of the copper mines, the aluminium fabricating plants are mostly owned by or very closely linked to the virgin aluminium ingot producers. When two large virgin ingot producers extended into the secondary aluminium ingot field it was clear that the pattern of virgin producers owning fabricating plants would be repeated in the secondary ingot side. Aluminium Limited, which is the largest supplier of virgin ingot to the U.K., had no secondary interest, so the new company suited us both. We remain competitors of Aluminium Limited's British fabricating subsidiary — Alcan Industries Limited—in our relatively small wrought aluminium side in ERMAL. Alenoy have started in an extremely satisfactory way, but at a time of great pressure on profit margins. The company has taken over the secondary aluminium interest of John Dale Limited from 1st January, 1961.

DIVIDEND POLICY

Your Board has considered what dividend policy they should recommend in these circumstances. We feel justified in recommending a 12½% final, despite the low dividend cover, in view of the unusual nature of some of 1960's adverse features.

GENERAL

You will appreciate that it has been an anxious year and this has placed all

ENFIELD ROLLING MILLS

Company Meeting continued

the greater strain on your managers and employees. That things are as good as they are reflects their efforts in difficult times and in your name I should like to thank them all for what has been done.

The level of activity so far this year is not unencouraging. Although below that of the beginning of last year, it is still at a good level and appears to be increasing. We have always said that the most we can promise is that we shall secure our full and fair share of the business in our lines which is offering. We remain as confident as ever that we shall achieve this and that the measures we have initiated to retrieve the position in the cable field will pay off.

The report and accounts were adopted.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Blackiston and Palmer Ltd., 1 Doncaster Rd, Scunthorpe. To take over business of domestic electrical appliance dealers carried on at Scunthorpe by L. C. Blackiston and C. G. Palmer, etc. Nom. cap.: £4,000. Permanent dirs.: Leslie C. Blackiston and Cyril G. Palmer.

Bowman, Smith and Co. Ltd., 152 Caledonian Rd, N.1. Electrical engineers and contractors, etc. Nom. cap.: £100. Dirs.: Arthur J. Bowman and Phillip J. Smith.

F. Devetta (Tapes) Ltd., Alma Hse, Rodney Rd, Cheltenham. Manufacturers of and dealers in industrial tapes and insulation and packaging materials, etc. Nom. cap.: £1,000. Dirs.: Fdk. Devetta, Henry D. Bolter and Miss C. Browning.

G.E.C. (Domestic Equipment) Ltd. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: P. M. Bevan-Thomas, 23 Wimpole St, W.1; and R. B. Catlow.

G.E.C. (Radio and Television) Ltd. Details similar to G.E.C. (Domestic Equipment) Ltd.

Metropolitan Audio and Electrical Domestic Appliances Ltd., 9 Marchmont St, W.C.1. Nom. cap.: £1,000. Dirs.: Kenneth A. Spratt and Rose G. Spratt.

Midvac Ltd., 130 Foleshill Rd, Coventry. Electricians, etc. Nom. cap.: £500. Dirs.: Donald A. Thomson and Dora Thomson.

Mylite Auto-Essentials Ltd., 22 York Pl, Leeds 1. Manufacturers of and dealers in electric lamps of all kinds; motor accessories, etc. Nom. cap.: £500. Dir. Ronald Myers.

Practical Electrics Ltd., 6 Surrey St, W.C.2. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Stanley H. Lucas and Francis A. Dean.

Rance Electrical Ltd., 27-29 Whitfield St, W.1. Nom. cap.: £100. Dirs.: Sydney F. G. Walker and Mary C. Walker.

G. N. Watts Electrical Ltd., 6 Melon Pl, Kensington Church St, W.8. Electrical and general engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: Albert E. Booth, David J. H. Broadway and George E. Burns.

Fred Weston (Electrical Contractors) Ltd., Tyn Rhyl Yard, Vale Rd, Rhyl. To take over business of electrical contractors carried on at Rhyl by F. Weston, etc. Nom. cap.: £2,500. Permanent dirs.: Fred Weston and Gwyneth F. Weston.

Reginald Wright Ltd., Gladstone Hse, Station Rd, Hesleden, West Hartlepool, Co. Durham. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Doris Wright and Reginald Wright.

MEETINGS TO NOTE

THURSDAY, 18 MAY

I.E.E. A.G.M. and "Experimental Investigation of Space," J. A. Ratcliffe. Savoy Pl, W.C.2. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Blackburn). "Electronics," J. Siddon. Castle Hotel, Blackburn. 7.30 p.m.

FRIDAY, 19 MAY

I.E.E. (Scottish). Spring meeting at Pitlochry Hydro Hotel, Pitlochry until 22 May.

A.S.E.E. Annual Conference at Grand Hotel, Brighton, until 21 May.

TUESDAY, 23 MAY

SOCIETY OF INSTRUMENT TECHNOLOGY. A.G.M. 6 p.m.; and Presidential Address, Manson Hse, 26 Portland Pl, W.1. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (South Wales). "The Measurement and Analysis of Noise in Factories," G. Berry. South Wales Engineers Institute, Park Pl Cardiff. 7.30 p.m.

A.S.E.E. (Portsmouth and District). Meeting with Electrical Association for Women. Committee Rooms, Ministry of Labour Offices, Lake Rd, Portsmouth. 7.30 p.m.

WEDNESDAY, 24 MAY

I.E.E. (Scottish). A.G.M. at Glasgow.

THURSDAY, 25 MAY

I.E.E. (Utilisation Section). "Electric Traction," J. A. Broughall. Savoy Pl, W.C.2. 5.30 p.m.

INSTITUTION OF PLANT ENGINEERS (Merseyside and North Wales). "Men, Method and Material —in that order?" K. S. London. The Blossoms, Chester. 7.15 p.m.

FRIDAY, 26 MAY

A.S.E.E. (Nottingham). Ladies' night. Grange Farm, Toton. 7 p.m.

SATURDAY, 27 MAY

INSTITUTION OF PLANT ENGINEERS (Birmingham). "Acoustics," E. G. Ewing. Imperial Hotel, Temple St, Birmingham. 7.30 p.m.

MONDAY, 29 MAY

I.E.E. SUMMER MEETING in London until 2 June.

TUESDAY, 30 MAY

INSTITUTION OF CIVIL ENGINEERS. Unwin Memorial Lecture: "The Work of the Institution's Research Committee," Professor J. F. Baker. Gt. George St, S.W.1. 5.30 p.m.

R.E.C.M.F. Show at Olympia until 2 June.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Adolite. B803,738. Class 11. Lamps, etc. Lamp Mnfg and Railway Supplies Ltd., Vincent Wks, Vincent La, Dorking, Surrey.

Barnacle. 815,483. Class 9. Panels for switches, plugs, sockets, etc. Barnacle Ltd., Bensham La, Croydon.

Dynomagic. 813,694. Class 11. Heaters incorporating fans or blowers. Berry's Electric Ltd., Touchbutton Hse, 85-86 Newman St, W.1.

Osotherm. 815,482. Class 11. Heating apparatus. Sterling Eng. Co. Ltd., Sterling Wks, Dagenham.

Phosphotron. 810,874. Class 9. Apparatus, including energised luminescent units, etc. Ericsson Telephones Ltd., 22 Lincoln's Inn Fields, W.C.2.

Timac. 817,072. Class 9. Apparatus, etc. Gillone Electric Ltd., "Rockstone Wks," Doman Rd, Camberley, Surrey.

Transacter. B803,529. Class 9. Automatic data collecting and communication apparatus, etc. General Time Corpn, 355 Lexington Ave, New York, N.Y., U.S.A.

Vibrette. 813,316. Class 9. Measuring instruments, etc. Electronic Instruments Ltd., Lower Mortlake Rd, Richmond, Surrey.

Aberdare Holdings Limited

Satisfactory Group Results

THE 25th ordinary general meeting was held on 16 May in London, Sir John Pascoe (the chairman) presiding.

The following is an extract from his circulated review: The consolidated Profit and Loss Account of Aberdare Holdings Limited and its Subsidiary Companies shows profits for the year, before taxation, of £640,759 against £672,425 for the previous year.

After charging tax at £296,975 against £294,261, the net profits of the Group amount to £343,784 as against £378,164.

Group's Activities

Aberdare Cables Limited: Although our turnover for the year ended 31 Oct., 1960, was reasonably well maintained, the unremunerative price level, to which I referred in May, 1960, obtained throughout the year. In spite of this, however, Aberdare Cables operated at a profit, an outcome we consider satisfactory under the circumstances.

At the present time, we are obtaining slightly higher prices, and with the improved turnover we expect the Cable Company to make a greater contribution to Group profits during the year.

South Wales Switchgear Limited: The rate of increase in turnover, to which I referred last year, was well maintained and the Company was, as in previous years, responsible for the greater part of the turnover of the whole Group and, in addition to this, it is gratifying to record that our exports amounted to, approximately, 30% of the total output.

The acquisition of all the minority shares of Treforest Electrical Services Limited was completed during the year and this permitted the operations of the latter Company to be merged in those of South Wales Switchgear, with the result of an expansion in our range of products in the direction of low voltage switchgear, and this, combined with the development in the Company's main factories has meant that the range of the Company's switchgear products has been considerably extended.

The operations of the Transformer Division are carried out in a factory on the Treforest Industrial Estate and here we have considerably increased the range of transformers manufactured.

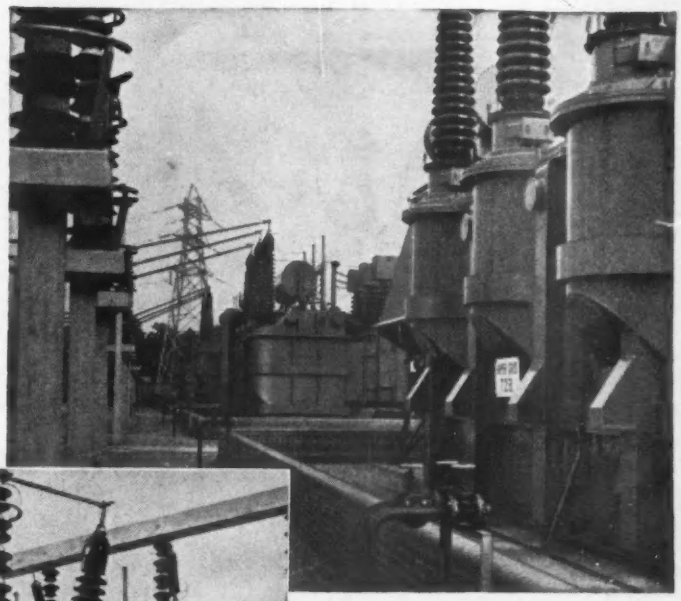
Aberdare Engineering Limited: The outputs of Aberdare Engineering Limited, Neckar Water Softener Company Limited and the Ivor Power Specialty Company Limited, were at a slightly higher level than the previous year, and since the end of the year the orders received by these Companies show a very gratifying rate of increase.

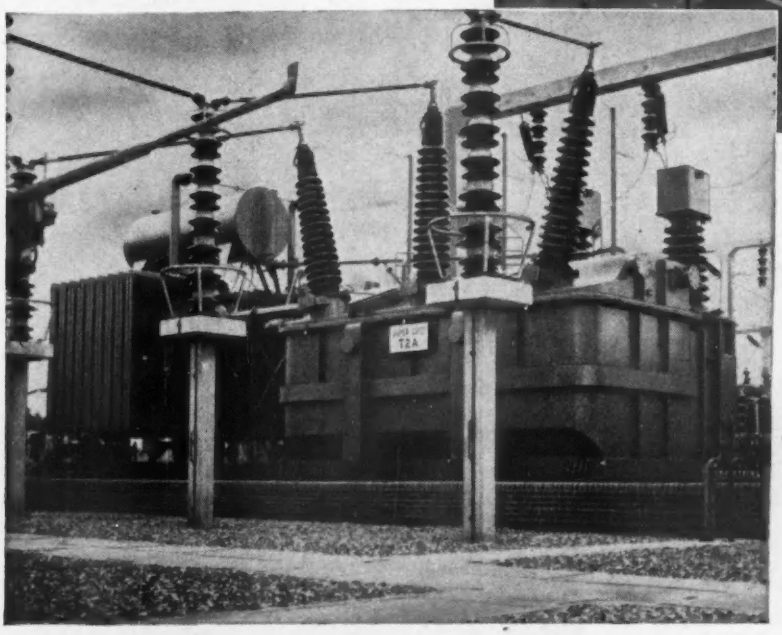
African Subsidiary Companies: South Wales Electric (Pty.) Limited and Aberdare Electric (Africa) Limited, the one manufacturing electrical switchgear and the other manufacturing transformers, continue their satisfactory progress.

The report and accounts were adopted and the final dividend of 10% less tax, making 17½% less tax, for the year was approved.

600 MVA AT FLEET

(Central Electricity Generating Board)





TWO 180 MVA

TWO 120 MVA

275/132 KV

HACKBRIDGE TRANSFORMERS

HACKBRIDGE AND HEWITTIC ELECTRIC CO. LIMITED

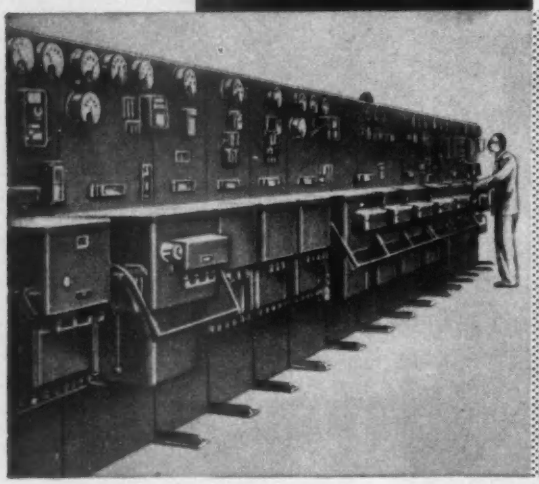
WALTON-ON-THAMES, SURREY, ENGLAND

Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: Electric, Walton-on-Thames

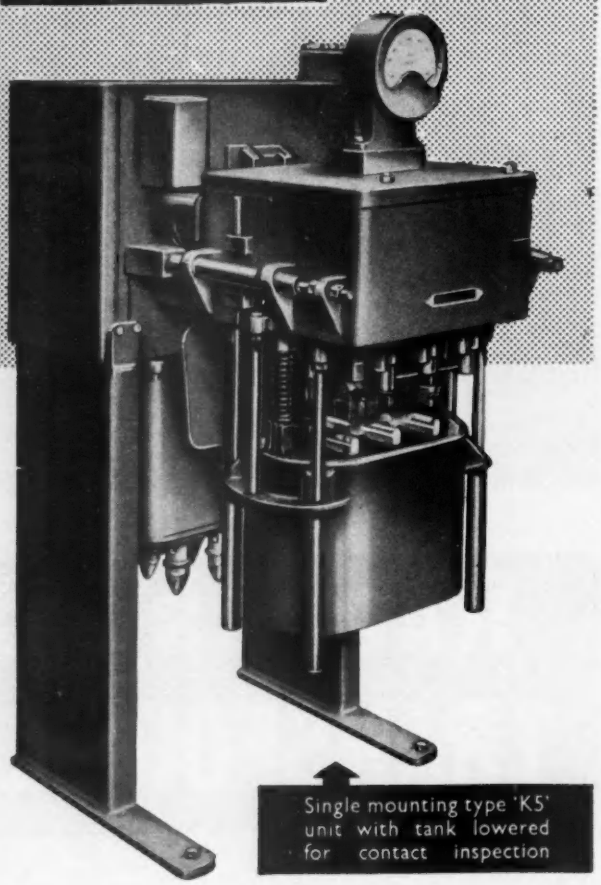
TYPES K & KC

Industrial Switchgear

Rating—up to 660v./2000a.



Switchboard consisting of types 'KC6' and 'KC4' units



Single mounting type 'K5' unit with tank lowered for contact inspection

Types K & KC Switchgear have been specially designed to provide a reliable power supply for industrial and commercial needs where the rating required is not in excess of 660V-2000A.

The Switchgear is available for pedestal or cubicle mounting and incorporates horizontal drawout circuit-breakers suitable for the control of all main and auxiliary power supplies.

Their unit construction permits single or switchboard mounting to meet individual requirements.

For further particulars write to AEI Switchgear Division, Higher Openshaw, Manchester, or to your local AEI office.

AEI

Associated Electrical Industries Ltd.

Switchgear Division

HIGHER OPENSHAW, MANCHESTER · TRAFFORD PARK, MANCHESTER · WILLESDEN, LONDON

F/A778

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF EALING
Conversion of Filament to Sodium Lighting

CONTRACT A: Supply of 3,600 lanterns, lamps and control gear.
Contract B: Supply of 1,500 brackets and 500 control gear boxes.

Details obtained from the Borough Engineer, Town Hall, Ealing, W.5, on payment of £5 for each contract, returnable on receipt of a bona fide tender

Closing date of tender: 30 May, 1961.

E. J. COPE BROWN,
Town Clerk.
(A 596)

TENDERS

Tenders are invited for the supply of all or any of the following:

1. Steel cored Aluminium Conductors.
2. Electric discharge lamps.

Specifications may be obtained on writing to the Purchasing Officer, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad W.I.

Closing date for Tenders: Monday, 10 July, 1961. (A 643)

CITY OF HEREFORD
Tenders for Street Lighting

TENDERS are invited for the provision of approximately 187 No. Group "B" lighting points in various roads in the City. 29 No. points are to be sodium discharge lamps with new columns. The remaining points are to have G.L.S. lamps and include erection of new concrete columns and conversion and resiting of existing gas columns.

Specifications, schedules and Form of Tender may be obtained from Mr. F. Margerison, A.M.I.C.E., City Surveyor, Town Hall, Hereford, on receipt of a deposit of £2 2s which will be returned on receipt of a bona fide tender.

Plans and conditions of contract may be inspected at the Surveyor's office during normal office hours.

Tenders, endorsed "Street Lighing," in the envelope provided, and bearing no name or mark to indicate the sender, must reach the undersigned not later than 9 a.m. on 5 June, 1961.

The Council do not bind themselves to accept the lowest or any tender.

J. A. WESTON,
Town Clerk.

Town Hall,
Hereford. (A 644)

GHANA SUPPLY COMMISSION

THE Ghana Supply Commission invite manufacturers to submit quotations for the following:

Ref.: ELEC.4058/1. Description: 4,600 Fluorescent Lighting Fittings complete, and Fluorescent Tubes.

Forms of Tender will be obtainable as from 22 May on payment of a fee of £1 from the Secretary, Ghana Supply Commission, P.O. Box M.35, Accra.

The closing date for the receipt of quotations will be 10 July, 1961. (A 673)

CITY OF HEREFORD
Electrical Installation to 147 traditional houses and 12 bungalows on Newton Farm 5 site, Hereford

TENDERS are invited for the wiring for electricity to 147 traditional houses and 12 bungalows on Newton Farm 5 site, Hereford.

Plans, specifications and form of tender may be obtained from the City Architect, Town Hall, Hereford, upon deposit of £1 1s (returnable following the submission of a bona fide tender and return of all documents).

Tenders should be returned in the envelope provided and endorsed "147 houses —12 bungalows, Newton Farm 5" to reach the undersigned not later than 12 noon on Friday, 9 June, 1961.

J. A. WESTON,
Town Clerk.

Town Hall,
Hereford. (A 625)

APPOINTMENTS VACANT

SOUTH WESTERN ELECTRICITY BOARD
AGRICULTURAL ASSISTANT (OR TRAINEE)
CORNWALL GROUP (POOL)

SALARY within the range of £1,040/£1,165 per annum.

The person appointed as an Agricultural Assistant will be required to advise farmers and market gardeners on the ways in which electricity can help in reducing operating costs and improving efficiency. His duties will include giving assistance in planning equipment layouts and drawing up suitable schemes; the selling of farming and horticultural equipment; assisting in maintaining contact with local representatives of agricultural organisations; advising and building up good relations with agricultural dealers, contractors and merchants.

The successful candidate will cover the County of Cornwall, but he may be required to give assistance occasionally in other parts of the Board's area.

Applicants should have had good practical farming experience (dairy, pig and poultry farming—including the marketing of livestock and produce—crop rotation and conservation), of market gardening (flowers and vegetables growing in field and glasshouse), and be widely experienced in the operation and application of electrical equipment in farming and horticulture. They should also possess a National, Agricultural College or Farm Institute Diploma or a Certificate in Agriculture or Horticulture or a National Diploma in Agricultural Engineering.

Candidates who have had a good practical farming and horticultural background but who do not possess the necessary experience of the use of electrical equipment in these subjects may be considered for an appointment as Agricultural Trainee. In this case, the initial appointment would be for a period of approximately twelve months, during which time the successful candidate would be able to gain the necessary experience for appointment as Agricultural

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Assistant; the salary during this training period would be within the range of £825/£940 per annum.

Applications to be made on standard form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the Group Administrative Officer, S.W.E.B., Pool, Redruth, Cornwall. Closing date for receipt of completed applications is 12 June, 1961.

THIRD ASSISTANT DISTRICT ENGINEER
PLYMOUTH

Salary within Class H, Grade 9, Salary Scale 8, £1,040/£1,165 per annum.

The successful candidate will be employed principally on supervising cable laying, and the installation of substation plant. He will also be expected to undertake general engineering duties, including standby.

Sound training in the distribution of the supply industry and experience in operating systems up to 11 kV is essential, and applicants should be competent to supervise labour. Qualifications leading to Corporate Membership of the Institution of Electrical Engineers are desirable, and possession of a current driving licence will be an advantage.

Applications to be made on standard form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the District Manager, South Western Electricity Board, Elliott Rd, Prince Rock, Plymouth. Closing date for receipt of completed applications is 5 June, 1961. (A 662)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
ENGINEERING DRAUGHTSMAN

REQUIRED at No. 2 Sub-Area Headquarters, Sandiway Hse, near Northwich, Cheshire. Salary within range £825/£940 per annum (N.J.B. L.15).

Applicants should be 21 years of age or over, have preferably served an electrical apprenticeship, and have obtained O.N.C. or equivalent in Electrical Engineering. Experience in the preparation of layout drawings of engineering plant and experience in the Electricity Supply Industry would be an advantage but not essential.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager at the above address. Closing date: 5 June, 1961. (A 655)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. appointments in the South Wales Division.

ASSISTANT ENGINEER
(MECHANICAL MAINTENANCE)
(BOILER AND TURBINE)
ABERTHAW POWER STATION, THE LEYS,
NR. BARRY, GLAM.
VACANCY No. 105/ET/61.

Salary: Schedule A, Class L, Grade 8, Scale 12, £1,350/£1,500 per annum.

Applicants should possess H.N.C. or equivalent qualifications and have had experience of boiler and turbine maintenance.

THIRD ASSISTANT ENGINEER
(EFFICIENCY AND TESTING SECTION)
GENERATION DEPARTMENT
DIVISIONAL HEADQUARTERS, CARDIFF
VACANCY No. 106/ET/61.

Salary: Schedule B, Class AX, Grade 8, Scale 10, £1,105/£1,325 per annum.

Applicants should possess a Higher National Certificate or equivalent qualifications and have experience of power station operation. Previous experience of power plant testing advantageous.

Special application forms obtainable from Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 2 June, 1961. (A 679)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

EASTERN ELECTRICITY BOARD

Area Headquarters

APPLICATIONS are invited for the following posts on Area Headquarters Staff but located at the Apprentice Training School, Harold Hill, Romford, Essex.

ASSISTANT SENIOR APPRENTICE INSTRUCTOR
114/61.N.

Candidates should have had sound practical and technical mechanical engineering training and must be able to lecture to and instruct apprentices in the basic mechanical engineering skills. Associate membership of the Institute of Industrial Supervisors or an equivalent qualification would be an advantage.

Salary: N.J.B. New Class BX11, Schedule B, £855/£1,165 (plus London Allowance). (From 1 July, 1961, the lowest step of this scale will be increased to £900.)

FOUR APPRENTICE INSTRUCTORS
115/61.N.

Applicants should preferably have served a regular apprenticeship or traineeship in mechanical engineering and have had considerable practical experience. Duties will include instruction of apprentices in basic workshop practice.

Salary: N.J.I.C. Schedule E, Grade 2, £795, plus London Allowance.

Apply by letter to the Secretary, Eastern Electricity Board, P.O. Box 40, Wherstead, Ipswich, by 16 June, 1961.

Chilterns Sub-Area

AYLESBURY DISTRICT

(a) TWO THIRD ASSISTANT ENGINEERS
117/61/N/R.

(b) ONE FOURTH ASSISTANT ENGINEER
118/61.R.

(c) ONE GENERAL ASSISTANT ENGINEER
119/61.R.

Candidates for positions (a) and (b) should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

Candidates for position (c) should have had a sound general and technical education. Some experience in the operation and maintenance of H.V. and L.V. distribution systems would be an advantage.

Salary: N.J.B. Class F, (a) Grade 9 (£890/£1,015); (b) Grade 11 (£765/£870); (c) Grade 13 (£670/£750).

Apply by letter, stating position applied for, to the Manager, Aylesbury District, Eastern Electricity Board, Exchange St, Aylesbury, by 2 June, 1961.

Essex Sub-Area

CHELMSFORD DISTRICT
FIRST ASSISTANT COMMERCIAL ENGINEER
113/61.R.

Candidates should have had a good technical and general education and experience in electrical contracting and maintenance work. The successful applicant will be responsible to the Commercial Engineer, Chelmsford District, for commercial development, supervision of Service Centres and wiring installation work, including estimating for all types of industrial, agricultural and domestic installations and such general consumer advisory service as would be anticipated in a District having important industrial, agricultural and housing development. He would also be responsible for operating an efficient maintenance service.

Salary: N.J.B. Class F, Grade 6, £1,115/£1,245 (subject to formal confirmation, Chelmsford District will be reclassified from 1 April, 1961, in which case the salary for this appointment will be Class G, Grade 6, £1,190/£1,325).

Apply by letter to D. H. Walker, A.M.I.E.E., Manager, Chelmsford District, Eastern Electricity Board, Anchor St, Chelmsford, Essex, by 2 June, 1961.

Northmet Sub-Area

ST. ALBANS DISTRICT
FOURTH ASSISTANT ENGINEER
116/61.R. (Ref. 1059)

Candidates should have had a sound technical training and suitable experience in

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the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class G, Grade 11 (£825/£940).

Apply by letter to F. J. Drake, ASSOCIATE I.E.E., Manager, Eastern Electricity Board, 107 St. Peter's St, St. Albans, by 29 May, 1961.

Suffolk Sub-Area

THIRD ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)
WOODLAND SUBSTATION
BADLEY, STOWMARKET
120/61.N.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of overhead and underground systems (including substations) up to 33 kV, together with experience of system control in a large rural area.

Salary: N.J.B. Class K, Grade 10 £1,115/£1,245).

The sucessful candidate will be required to reside near to Woodland Substation.

Applications in writing, stating age, education, qualifications and experience, with details of present appointment, should be addressed to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, by 2 June, 1961. (A 646)

KENT EDUCATION COMMITTEE

North-West Kent College of Technology

ELECTRICAL ENGINEERING DEPARTMENT
GRADE B ASSISTANT

REQUIRED to teach Electrical subjects to National Certificate and Technician classes. Specialised experience in a power engineering subject would be an advantage. Industrial and/or teaching experience essential. Present salary scale: £700 x £27 10s—£1,150 p.a. Scales in process of revision.

Forms of application are obtainable from the Principal at the College, Miskin Rd, Dartford, to whom they should be returned as soon as possible. (A 613)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

DEMONSTRATOR

REQUIRED in the Crewe District of the Board's No. 4 Sub-Area, based on Crewe.

Salary within the range £600/£700 per annum (N.J.C. Grade 1).

Candidates should be over 21 years of age with demonstrating experience.

They should have a good knowledge of electrical appliances, and be competent to arrange and give public demonstrations of cooking, laundering and housecraft subjects. The possession of a recognised Diploma in Domestic Science or other approved certificate desirable. The post is active and interesting involving wide contact with the public, particularly women's organisations, schools and housewives.

Possession of a current driving licence would be an advantage.

Good holiday, sick pay and pension schemes.

Appointment subject to medical examination.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Rhostyllen, nr. Wrexham, or from any District Office. Closing date: 31 May, 1961.

Previous applicants need not re-apply. (A 638)

ADMINISTRATIVE COUNTY OF LEICESTER

ASSISTANT ELECTRICAL ENGINEER
£960/£1,310

CANDIDATES must be Associate Members of the Institution of Electrical Engineers or be in possession of the Higher National Certificate and be experienced in the design of electrical installations for all types of buildings. Removal expenses and lodging allowance may be paid to a married man. Apply on form available from the County Architect, 123 London Rd, Leicester. (A 568)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region
North Thames Division

APPLICATIONS are invited for the following appointments:

DIVISIONAL ELECTRICAL DEPARTMENT
(SYSTEM DEVELOPMENT SECTION)
DIVISIONAL HEADQUARTERS
COCKFOSTERS (NORTH LONDON)
THIRD ASSISTANT ENGINEER
(S.V. No. 1456)

Salary: N.J.B. Class AX, Grade 6, Scale 12, £1,285/£1,500 per annum, plus London Weighting £50 per annum.

The successful applicant will be required to assist in the preparation of system reinforcement schemes entailing the technical and economic appraisal of schemes and the preparation of reports.

A knowledge of network analyser practice, symmetrical component analysis and of the design of high voltage transmission systems would be an advantage. Applicants should have had a sound technical training and experience in this type of work and/or in the construction and operation of high voltage systems. They should preferably have qualifications in electrical engineering equivalent to corporate membership of the Institution of Electrical Engineers.

THIRD ASSISTANT ENGINEER
(S.V. No. 1457)

Salary: N.J.B. Class AX, Grade 8, Scale 10, £1,105/£1,325 per annum, plus London Weighting £50 per annum.

The successful applicant will be required to assist in the preparation of system reinforcement schemes and in the carrying out of calculations of fault levels, load flows, etc., necessary for the technical and economic appraisal of design schemes. A knowledge of network analyser practice, symmetrical component analysis and of the design of high voltage transmission systems would be an advantage.

Applicants should have had a sound technical training and should preferably have qualifications in electrical engineering leading to corporate membership of the Institution of Electrical Engineers.

Applications, quoting the appropriate Reference S.V. No., stating age, qualifications, experience and present position, should be sent to the Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, by 27 May, 1961. (A 617)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

REGIONAL ELECTRICAL DEPARTMENT

APPLICATIONS are invited from suitably qualified engineers for appointments in the Technical Branch of the Regional Electrical Department based on Leeds.

(1) SECOND ASSISTANT ENGINEER
(PLANNING)

Salary: Grade 4 BX (Max. £1,830).

To take charge of a group of engineers engaged in short circuit, load flow, stability and other system calculations, with the aid of a.c. and d.c. calculators.

(2) TWO THIRD ASSISTANT ENGINEERS
(PLANNING)

Salary: Grade 6 BX (Max. £1,610).

To investigate schemes of reinforcement of supply to the North Eastern and Yorkshire Electricity Boards and to prepare design reports making the necessary recommendations.

(3) THREE THIRD ASSISTANT ENGINEERS
(PLANNING)

Salary: Grade 7 BX (Max. £1,500) or BX8 (Max. £1,410), depending on qualifications and experience.

To assist with system calculations or with duties similar to those given in (2) above.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 30 May, 1961. (A 614)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPLICATIONS are invited for the following superannuable appointments.

(a) FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, MOTHERWELL DISTRICT

(b) FOURTH ASSISTANT ENGINEER, TEST DEPARTMENT, MOTHERWELL

Applicants for appointment (a) should be corporate members of the Institution of Electrical Engineers or possess qualifications leading to corporate membership, have experience in the various applications of electricity and be conversant with Tariffs, Sales and all aspects of service to consumers.

Salary: £1,275/£1,410 per annum in accordance with Class G, Grade 5 (Scale 11), of the National Joint Board Salary Scale.

Applicants for appointment (b) should possess technical qualifications preferably to H.N.C. standard, and have had a sound engineering training. They should have had some experience in testing and commissioning modern protective equipment and should be conversant with voltage drop and short circuit calculations and H.V. fault location.

Salary: £965/£1,090 per annum in accordance with Class L, Grade 13 (Scale 7), of the National Joint Board Salary Scale.

The successful applicants will require to reside within a reasonable distance of District Office/Test Department, Motherwell.

Forms of application, obtainable from the Manager, Montrose Cres, Hamilton, should be returned within 14 days of the appearance of this advertisement. (A 648)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

FOURTH ASSISTANT ENGINEER (OVERHEAD LINES) TRANSMISSION DEPARTMENT SEC/3.151.

THE successful applicant will be required to supervise contractors and to work at Divisional Headquarters on matters concerning the construction of 275 kV and 132 kV overhead lines.

Preference will be given to candidates who possess qualifications admitting them to graduate membership of the Institutions of Electrical, Mechanical or Civil Engineers.

Salary: N.J.B. AX9, £1,005/£1,245.

THIRD ASSISTANT ENGINEER (CABLES) TRANSMISSION DEPARTMENT SEC/3.152.

Preference will be given to those with experience in investigational work, the use of testing instruments and the ability to carry out an analysis of results.

Membership of the Institution of Electrical Engineers or the possession of equivalent qualifications will be an advantage.

Salary: N.J.B. AX8, £1,105/£1,325.

Special application forms (not A.E.6/ACT) obtainable only from Divisional Secretary, 111 High St, Portsmouth, should be returned by 26 May, 1961. (A 616)

BOROUGH OF WILLESDEN

Borough Engineer & Surveyor's Department

APPLICATIONS are invited for the appointment of:

SENIOR ELECTRICAL ENGINEERING ASSISTANT

Salary with APT. Grade III (£960/£1,140 p.a.).

Candidates must possess appropriate qualifications and should have experience in the design of electrical installation in multi-storey blocks of flats and public buildings.

The Council cannot assist with housing.

Full details and form of application may be obtained from the Borough Engineer and Surveyor, Town Hall, Dyne Rd, Kilburn, N.W.6, and must be returned to the undersigned not later than 10 a.m., on Monday, 29 May, 1961.

(Signed) R. S. FORSTER,
Town Clerk.
(A 551)

CENTRAL ELECTRICITY GENERATING BOARD

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London Allowance.

FOURTH ASSISTANT ENGINEER ELECTRICAL DEPARTMENT TRANSMISSION SECTION GENERATION HOUSE Vacancy No. 61/292.

Applicants should have had a sound technical training, preferably with qualifications leading to Corporate Membership of the I.E.E. and experience in the maintenance of high voltage switchgear, transformers, lines and cables. With the expected growth of the Grid System in the London Area, these positions offer great opportunities for experience in Transmission practice up to the highest voltages.

Salary: Class BX, Grade 11, £905/£1,215 per annum.

Applications quoting vacancy number may be made to (or on form from) Personnel Department, Central Electricity Generating Board, Generation Hse, P.O. Box No. 136, Great Portland St, London, W.1, to be received not later than 30 May, 1961. (A 628)

COUNTY BOROUGH OF BLACKPOOL

APPLICATIONS invited for appointment of a

SENIOR TECHNICAL ASSISTANT (APT. III/IV—£960/£1,310).

Candidates should hold qualifications of Grad. I.E.E. or similar standard, and have experience of specification drafting and contract supervision for lighting and electrical installations and knowledge of distribution networks.

Application form and conditions from Director of Lighting and Electrical Services, Rigby Rd East, Blackpool, to whom they should be returned by 30 May, (A 615)

THE SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following positions:

Cardiff and East Central Area

(a) GENERAL ASSISTANT ENGINEER BARRY DISTRICT (Ref. 61/61/ET.)

The duties of this position will be of a general nature and preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class F, Grade 9, Scale 6, £890/£1,015 per annum.

(b) GENERAL ASSISTANT ENGINEER (DRAUGHTSMAN) CARDIFF DISTRICT (Ref. 62/61.ET.)

Salary: N.J.B. Class J, Grade 11, Scale 7, £965/£1,090 per annum.

Applications, stating age, present position, present salary, qualifications, experience and endorsing envelope with the appropriate reference should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, Colchester Ave, Cardiff, to arrive not later than 3 June, 1961.

Swansea and West Central Area

(c) GENERAL ASSISTANT ENGINEER PORT TALBOT DISTRICT (Ref. 63/61/ET.)

The duties of this post will be of a general nature and preference will be given to Engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class H, Grade 9, Scale 8, £1,040/£1,165 per annum.

Applications stating age, present position, present salary, qualifications, experience and endorsing envelope with the appropriate reference should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, to reach him not later than 3 June, 1961.

R. G. WILLIAMS,
Secretary.
(A 635)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

COAL AND ASH HANDLING ENGINEER

REQUIRED for Stourport "A" and "B" Power Stations, N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K8, £1,275/£1,410 per annum.

The successful applicant will be responsible to the Station Superintendent for the coaling and ash disposal arrangements on the power station site. The possession of an appropriate technical qualification will be an advantage.

Apply, quoting Vacancy No. 135/61MD on form AE6 available from the Station Superintendent, Stourport "A" and "B" Power Station, Severn Side, Stourport-on-Severn, Worcs, to whom they should be returned by 29 May, 1961. (A 626)

THE NORTH WESTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER NORTH DISTRICT, SALFORD

DUTIES will include assisting the District Commercial Engineer in dealing with consumers' requirements and enquiries on all matters, including sale and installation of apparatus, repairs and maintenance, emergency service and tariffs, new supplies and development, control of workshops and service centres, and preparation of specifications and estimates.

Salary scale: £1,350/£1,500 p.a. Grade G.4. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester 2, P.O. Box 493, and returned to him by 29 May, 1961.

RECORDING DRAUGHTSMAN LANCASTER DISTRICT

Applicants must have received a good general education and possess good penmanship. The duties will include the taking of details on site, the preparation of mains map records and general cartographic work, and other duties as required.

Applicants should state their experience and training in drawing and tracing.

Salary scale: £600 x £25—£700 p.a. Grade 1. N.J.C. conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, and returned to him by 29 May, 1961.

FOURTH ASSISTANT DISTRICT ENGINEER ROCHDALE DISTRICT

The duties will include assistance in the operation, maintenance and construction of substations and H.V. and L.V. underground and overhead mains, fault location and the general maintenance of supply in the District. The successful applicant will be required to undertake standby duties.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale: £890/£1,015 p.a. Grade H.11. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, and returned to him by 29 May, 1961. (A 639)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

LITTLEBROOK POWER STATION VACANCY No. 144/61 ASSISTANT ENGINEER (RELIEF)

DUTIES will include assisting Charge Engineers in operational duties and acting as observers in testing of plant. General engineering experience and/or engineering apprenticeship preferred.

Salary: N.J.B. Class L, Grade 14, £940/£1,065 per annum, including London Allowance, plus Shift Allowance when applicable.

Applications, giving age, details of experience, qualifications, etc., should be sent to Station Superintendent, Littlebrook Power Station, Nr. Dartford, Kent, to arrive by 31 May. (A 645)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, experience, etc., and quote the appropriate Vacancy Number.

Leicestershire and Warwickshire Sub-Area

THIRD ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
Vacancy No. 54/61.

Salary: N.J.B. Class K, Grade 11, £1,040—£1,165 per annum.

The duties of the successful candidate will include the planning of 11 kV/LV development and system reinforcement associated with a large urban and rural distribution network.

Ability to drive a car is desirable.

Applications should be addressed to the Manager, Leicestershire and Warwickshire Sub-Area, Upper Bond St, Hinckley, Leicestershire, to reach him by 1 June, 1961.

Northamptonshire Sub-Area

FOURTH ASSISTANT DISTRICT
COMMERCIAL ENGINEER
KETTERING DISTRICT
Vacancy No. 55/61.

Salary: N.J.B. Class G, Grade 11, £825—£940 per annum.

Applicants should be competent to advise on matters relating to the installation and operation of electrical equipment, including domestic, industrial and farming appliances. They should be conversant with tariffs and capable of preparing estimates for electrical installations and generally advising consumers on the use of electricity.

Applications should be addressed to the Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, to reach him by 1 June, 1961. (A 653)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a

SECOND ASSISTANT ENGINEER

in the System Design Section of the Chief Engineer's Department at Board Head Office.

The successful candidate will be engaged on the design of the Board's distribution system. Candidates should have had previous experience in the construction and operation of distribution systems and some experience in their design would be an advantage. They should possess an engineering degree or qualifications for Corporate Membership of the Institution of Electrical Engineers.

Salary: N.J.B. Class BX, Grade 5, £1,375/£1,720 per annum.

Applications on the standard form, quoting Reference E15/61, should be returned to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 2 June, 1961. (A 650)

MIDLANDS ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER
(SHIFT CONTROL)

REQUIRED in the Control Centre of the Worcestershire Area Office. Duties will include assisting the Shift Engineer to carry out all functions associated with a High Voltage System Control.

Applicants should have had technical training together with experience of switching operations and maintenance work on H.V. distribution equipment.

Salary: £890/£1,015 per annum, plus 10% shift allowance (Minimum £90). (N.J.B. Grade K.13). Superannuable.

Apply, by letter, within 14 days, stating age, experience, present position and salary to Area Manager, Midlands Electricity Board, P.O. Box 52, Blackpole Rd, Worcester.

F. W. CATER,
Secretary.
(A 637)

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

SENIOR ASSISTANT ENGINEER
(CONSTRUCTION)

APPLICANTS should have had considerable experience in substation construction, including the associated building and civil works, the construction of overhead lines and the installation of underground mains operating at voltages up to and including 66 kV. The successful candidate will be required to take administrative control of the Sub-Area Construction Section. Applicants should be Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary: N.J.B. Class L, Grade 4 (Scale 16), £1,795/£1,950 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 2 June, 1961.

No. 1 (Bradford) Sub-Area

THIRD ASSISTANT ENGINEER
(DISTRIBUTION DESIGN)

Applicants should possess technical qualifications equivalent to those for Corporate Membership of the Institution of Electrical Engineers and have experience in planning, design and estimating of medium and high voltage overhead and underground distribution systems. Experience in the construction and maintenance of such systems would be an advantage.

Salary: N.J.B. Class L, Grade 10 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford 1, not later than 2 June, 1961.

No. 4 (Leeds) Sub-Area

FOURTH ASSISTANT ENGINEER
(METERS, TESTING AND PROTECTION)

The successful applicant will initially be attached to the Meter Test Section and will have an opportunity of transferring to the Protection Section later.

Applicants should possess the Higher National Certificate or equivalent qualification.

Salary: N.J.B. Class L, Grade 13 (Scale 7), £965/£1,090 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, nr. Leeds, not later than 2 June, 1961. (A 663)

COUNTY BOROUGH OF BARROW-IN-FURNESS

Borough Engineer and Surveyor's Department

STREET LIGHTING AND ELECTRICAL SECTION
JUNIOR ENGINEER

APPLICATIONS are invited for this post on Grades APT 1-2 (£645/£960). The commencing salary will be fixed according to the experience of the successful applicant and is expected to be in the upper part of the grade.

The section which is expanding is responsible for the design, installation and maintenance of street lighting and electrical work and equipment in all Corporation properties including new buildings.

Candidates must have had appropriate training preferably holding the Higher National Certificate in Electrical Engineering, but suitable men with O.N.C. will be considered. Experience in the class of work covered by the Section including the preparation of plans, specifications and estimates is desirable.

The Department works a five-day week.

Further details of the post, conditions of appointment and forms of application may be obtained from the Borough Engineer and Surveyor, to whom completed applications must be returned not later than Friday, 26 May, 1961.

LAWRENCE ALLEN,
Town Clerk.
Town Hall,
Barrow-in-Furness. (A 666)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

ASSISTANT ENGINEER (RELIEF)
WARWICK POWER STATION
Vacancy No. 103/61.

APPLICATIONS are invited for the position of Assistant Engineer (Relief) at Warwick Power Station, Emscote Rd, Warwick.

This post offers an opportunity to gain experience in the Electricity Supply Industry in which there are excellent prospects of advancement.

Preference will be given to candidates who are at present pursuing a course of study with the object of obtaining the Higher National Certificate in Electrical or Mechanical Engineering, or a similar qualification.

Salary will be in accordance with Class E, Grade 12 (£670/£750 per annum) of the National Joint Board Agreement, and will progress ultimately to £805 per annum whilst engaged on shift duties.

Closing date for receipt of applications: 2 June, 1961.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official forms AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.
(A 651)

J. & P.

NEW SWITCHGEAR TENDERING AND DRAWING OFFICES

In

MANCHESTER, BIRMINGHAM & BRISTOL

As part of the planned expansion of their Switchgear Department, Johnson and Phillips Limited plan to open offices in Manchester, Birmingham and Bristol for the preparation of tenders and the handling of contracts. Applications are invited from:—

(a) Experienced contract engineers used to handling switchgear enquiries and orders.

(b) Young men with H.N.C. or equivalent who would like to train for these duties (this would involve a period at the London works).

(c) Experienced switchgear draughtsmen.

(d) Young draughtsmen, minimum qualification O.N.C., who would like to take up Switchgear Work (this would involve a period at the London Works).

J. & P. are one of the largest independent firms in the Electrical Industry with factories in England, S. Africa, Australia, India and Pakistan. They make a wide range of switchgear for medium and high voltage applications. Local interviews will be arranged, but in the first instance please send full details of qualifications, experience and present salary and state at which office you are prepared to work, to the Employment Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7. (A 630)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

DEPUTY POWER STATION SUPERINTENDENT
WHITEHALL ROAD POWER STATION

APPLICATIONS are invited for the appointment of Deputy Superintendent at Whitehall Rd Power Station.

Applicants should have had a wide experience in the operation and maintenance of generating plant.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule A, Grade 3, Class E (£1,275/£1,410 per annum).

This is a re-advertisement and previous applicants need not re-apply.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 7 June, 1961. (A 670)

ADEN

TELEPHONE PLANNING ENGINEER
POSTS AND TELEPHONES DEPARTMENT

DUTIES: To supervise the development of the Aden Colony telephone system on orthodox British Post Office lines.

Qualifications: Candidates (preferably aged between 30-40 years) must possess Corporate or Graduate Membership of the Institution of Electrical Enginers, or an engineering degree or telecommunication qualification conferring exemption from the Institution's examination. They must also have had practical experience at senior supervisory or executive level of the development and maintenance of automatic exchanges of between 1,000 and 5,000 lines.

Terms of Appointment: On contract for one tour of 18-24 months. Salary according to qualifications, experience and post-war national military service in scale £1,067/£2,004. A salaries revision is impending. Gratuity. Children's and education allowances. Free passages. Outfit allowance. Government quarters available at moderate rental. Generous home leave.

Write Director of Recruitment, Colonial Office, London S.W.1, quoting BCD 108/2/07/ET.D.10 and giving full names, age, qualifications and experience. (A 636)

ELECTRICAL DRAUGHTSMEN!

By its continuing expansion and rapid development in automative and mechanical techniques in production, the food industry offers a widening scope to progressive electrical draughtsmen.

Foremost is H. J. Heinz Co. Ltd., manufacturers of the '57' Varieties, who require a draughtsman at their headquarters at Harlesden, North-West London.

He will design and prepare drawings for power and lighting installations and for control schemes for automatic processes, etc., and if suitably experienced, exercise some supervision of contractors.

Preferably candidates should be qualified to H.N.C. (Electrical) standard, but less qualified men will be considered if they have adequate experience. The initial salary will be in line with qualifications, experience and ability, and future progress both in responsibility and salary will be on a personal merit basis.

Please apply with a brief outline of personal history to date, to:

The Personnel Officer,
H. J. Heinz Co. Ltd.,
Waxlow Rd, Harlesden,
London N.W.10.

(A 647)

LONDON ELECTRICITY BOARD

TECHNICAL OFFICERS
DESIGN AND PLANNING BRANCH (2)

APPLICATIONS are invited for the undernoted positions in the Chief Engineer's Department at Lesco Hse, Stamford St, London S.E.1.

TECHNICAL OFFICER
PER/V/3290/T.

The post is graded under Schedule B of the National Joint Board Agreement as Grade 8, Class BX, and the commencing salary will be in the range of £1,155/£1,460 per annum, inclusive of London Allowance.

TECHNICAL OFFICER
PER/V/3291/T.

The post is graded under Schedule B of the National Joint Board Agreement as Grade 6, Class BX, and the commencing salary will be in the range of £1,345/£1,670 per annum, inclusive of London Allowance.

Applicants should have received a good education in engineering preferably holding a degree. They should have had a sound practical training and Corporate Membership of the Institution of Electrical Engineers would be desirable.

Application form obtainable from the Personnel Officer, 46 New Broad St, London E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote appropriate reference number. (A 657)

CENTRAL ELECTRICITY GENERATING BOARD

APPLICATIONS are invited for the following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London Allowance.

THIRD ASSISTANT ENGINEER
ELECTRICAL DEPARTMENT
TECHNICAL SECTION
SYSTEM DEVELOPMENT
GENERATION HOUSE
Vacancy No. 61/286.

Applications are invited for the above post. The successful candidate will be required to carry out duties connected with the preparation of system reinforcement schemes entailing technical and economic appraisal of schemes and preparation of reports. Applicants should have experience in the manufacture and testing of electrical equipment in the Supply Industry and should be familiar with symmetrical component theory and methods of network analysis. They should have qualifications in electrical engineering equivalent to Graduate Membership of the Institution of Electrical Engineers. Salary: Class BX, Grade 8, £1,155/£1,460 per annum.

Applications quoting vacancy number may be made to (or on form from) Personnel Department, Central Electricity Generating Board, Generation Hse, P.O. Box No. 136, Great Portland St, London, W.1, to be received not later than 30 May, 1961. (A 627)

THE NORTH EASTERN ELECTRICITY BOARD

York Sub-Area

SUB-AREA COMMERCIAL OFFICER

APPLICATIONS are invited for the appointment of Sub-Area Commercial Officer at Sub-Area Headquarters, York.

Applicants should preferably be Chartered Electrical Engineers. The person appointed will be directly responsible to the Sub-Area Manager for the co-ordination of the activities of the Commercial Staff in the Sub-Area, and should have had extensive practical experience in industrial, commercial domestic and agricultural development, including the supervision of service centres and contracting departments. Experience in the negotiation of supply agreements for special supplies and public lighting is desirable.

Salary in accordance with N.J.M. and H.E. Grades Agreement, Class B, Grade 5, £1,965/£2,170 per annum.

Applications with fullest details should be marked "Confidential" and be received by the Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, not later than 2 June, 1961. (A 664)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

THIRD ASSISTANT ENGINEER (PLANNING)
POST A
THIRD ASSISTANT ENGINEER
(CONSTRUCTION)
POST B

REQUIRED in the Chief Engineer's Department at Board Headquarters, Love La, Pall Mall, Liverpool 3. Commencing salary at a suitable point within the range: £1,105/£1,325 per annum (N.J.B. AX.8).

Applicants should have a thorough technical training and be suitably qualified.

For *Post A* they should have a knowledge of the economic factors governing the design and planning of Distribution networks.

For *Post B* they should have general knowledge of substation plant design, and duties will include assistance in the preparation of specifications and design of substations operating at voltages up to and including 33 kV.

Appointments subject to medical examination. Pension Scheme.

Application forms, obtainable from the Establishments Officer at the above address, should be returned not later than 9 June, 1961. (A 659)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

West Midlands Division

APPLICATIONS are invited for three positions as

ASSISTANT ENGINEERS

in the Hams Hall Group of Power Stations. Vacancies exist in both the operation and maintenance department. N.J.B. service conditions, superannuable appointments, salaries within scale 5 of the National Joint Board Agreement. £825/£940 per annum. An additional 10% (£90 minimum) will be paid for those positions where shift duties are performed.

Applicants should have previous experience either in power stations or large industrial works, and they should hold appropriate technical qualifications.

Apply, quoting vacancy no. 136/61MD, on form AE6, available from the Station Superintendent, Hams Hall Power Station, Lea Marston, Sutton Coldfield, Warks, to whom they should be returned by 29 May, 1961. (A 654)

DEWHURST & PARTNER LIMITED

TECHNICAL SALES ENGINEERS

Due to expansion programme, coupled with the promotion of existing staff, the following additional staff appointments will shortly be made:

(a) Resident Engineer and Sales Manager (Western Counties).

(b) Senior Technical Representatives Manager (Western Counties).

(c) Junior Technical Representatives (Midland Counties).

All applicants must have manufacturing knowledge of automatic motor control equipment, coupled with technical background in this field. Applicants for positions (a) and (b) must have proven sales experience, and record with Companies manufacturing similar types of equipment. All appointments are pensionable under the company pension fund, and in the case of positions (a) and (b) a Company car will be provided.

Confidential applications in writing in the first instance giving age, experience, qualifications and salary required, to the Personnel Officer, Dewhurst and Partner Ltd., Inverness Wks, Hounslow, Middx, stating position for which application is made.

(A 681)

AIR MINISTRY

ASSISTANT MECHANICAL AND ELECTRICAL ENGINEERS

FOR design construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports.

SALARY according to age, quals. and exp. from £936 (at 25) to £1,430 max., with increase for London and slight decrease in country districts. In addition salary is increased by £75 p.a. (within the maximum of scale) after two years' approved service, subject to being corporate members of Institution of Mechanical or Electrical Engineers. Appointments long term with good prospects of pension and advancement to numerous posts in higher grades, viz.:

Mechanical and Electrical Engineers: £1,456/£1,950, 125 posts;

Senior Mechanical and Electrical Engineers: £2,080/£2,392, 34 posts;

Superintending and above Mechanical and Electrical Engineers: £2,650 upwards, nine posts.

Vacancies occurring in higher grades are filled by promotion of existing staff.

Good opportunities for acquiring exp. overseas where special allowances ranging at present up to £1,800 p.a., according to location and marital status, are payable in addition to higher salary. Five-day week with four weeks' two days' paid leave p.a. initially.

QUALS.: (a) University degree or equiv. diploma in electrical and/or mechanical engineering with at least two years' apprenticeship; or (b) Graduate or corporate member of I.E.E. with at least three years' apprenticeship; or (c) Graduate or corporate member of I.Mech.E. appreciable electrical engineering exp. with at least three years' apprenticeship. In addition, all candidates should have been employed for min. of two years with well-established engineering concern and gained wide exp. in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects between ages 25 and 35. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D 128/1A. Selection will be by interview in London and certain expenses will be reimbursed. (A 205)

Circuit Design Engineer

required

to assist Chief Engineer in basic development of new circuits, etc., requiring new techniques.

The age bracket is not of importance but the successful applicant will be paid an excellent salary providing he can satisfy the executive of his capabilities relative to his abilities to deal with circuit problems and calculations using his initiative and experience gained in a good sphere of activity in a similar type of work.

A basic background of lift and crane control applications would be given a priority consideration.

The position would be in the London area.

Pension Fund, Canteen facilities.

Confidential replies in the first instance, giving age, experience and present salary range, should be addressed to the Personnel Officer, Box No. 8309, Electrical Times.

(A 682)

WANDSWORTH TECHNICAL COLLEGE

Wandsworth High Street, S.W. 18

REQUIRED owing to expansion of work:

LECTURER FOR ELECTRICAL ENGINEERING

(C. and G. Technician's Courses and National Courses in Power and Electronics). £1,408 x £35—£1,601.

TWO ASSISTANT LECTURERS, GRADE B

£738 x £27 10s—£1,201. (a) Metallurgy to O.N.C., H.N.C. and L.I.M. levels; (b) Engineering subjects up to H.N.C. standard Mechanical or Production Engineering

For these posts graduate or equivalent qualifications required; industrial and teaching experience desirable. Increments within salary scale for appropriate experience; additions to Grade B scale for qualifications and training.

Application form from Secretary, returnable within 14 days. Please quote FE.3a/T/1304/5. (A 667)

SOUTHERN ELECTRICITY BOARD

DEMONSTRATOR

SOUTHAMPTON District of No. 4 Bournemouth Sub-Area. Salary: N.J.C. Grade 1 (£600 x £25—£700 per annum). N.J.C. Conditions of Service.

Applicants should be qualified to advise generally on the utilisation of electrical domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, Hants, and returned to him, quoting Z.1352, not later than 29 May, 1961. (A 661)

PIRELLI-GENERAL CABLE WORKS LTD.

Have vacancies for

PLUMBER JOINTERS

for work on all types of cables including oil-filled cables of the highest voltages. If necessary training will be given. Applications for training are especially invited from men who have previous experience or knowledge of electrical work.

The work will be in various parts of the country, and an outside allowance will be paid to people working away from home.

Application should be made in writing to the

Manager, Installation Division,
Pirelli-General Cable Works Ltd.,
Eastleigh, Hants. (A 634)

GOVERNMENT OF THE FEDERATION OF RHODESIA AND NYASALAND

ASSISTANT ELECTRICAL ENGINEERS MINISTRY OF WORKS

APPLICATIONS are invited for appointment as Assistant Electrical Engineers. Applicants must hold the minimum qualifications of a B.Sc. Degree of an approved University, or be a graduate member of the Institution of Electrical Engineers. Previous relevant experience of office work is essential.

The successful applicants will be appointed on contract for three years on the following salary scale:

1st year: £1,785.

2nd year: £1,863 15s.

3rd year: £1,942 10s.

The successful applicants will be stationed in Salisbury initially, but will be subject to transfer. They will each be responsible, through a Senior Officer, for design and preparation of specifications for various types of electrical installations, including site distribution schemes up to 11 kV, and supervising the work of two or more technical assistants.

Family passages provided, generous leave, medical aid, low income tax, opportunities, sports and recreation in pleasant climate.

Application forms and further details from the Secretary (R), Rhodesia Hse, 429 Strand, London W.C.2.

Closing date: 31 May, 1961. (A 660)

SENIOR DESIGN DRAUGHTSMAN

required to take charge of Drawing Office in expanding company in South West Surrey specialising in the design and manufacture of low tension switch and fuse gear. Write, giving full details to Box No. 8289, Electrical Times. (A 559)

W. T. GLOVER & CO. LTD.

ASSISTANT DISTRICT MANAGERS

required for the Sales Organisation to operate in the Greater London area.

Applicants should be in age range of 25/40 and must have an aptitude for selling, a knowledge of the distribution side of the Electrical industry and have established connections with power cable users.

These appointments carry attractive salaries with good prospects for advancement.

Car provided.

Contributory Pension Scheme in operation.

Existing holiday arrangements will be honoured.

Interviews can be arranged in London.

Applications, giving details of age, training, qualifications and experience, should be forwarded to the Secretary, W. T. Glover and Co. Ltd., Trafford Park, Manchester 17. (A 633)

AIR PRODUCTS LIMITED

ELECTRICAL ENGINEER

Our Company, which designs, manufactures, erects and operates TONNAGE OXYGEN PLANT wishes to appoint a CHARTERED ENGINEER.

He should be conversant with the specifications of H.T. Switchgear, large drive motors and motor control equipment. He will be responsible to the Senior Electrical Engineer for drawing up specification and system diagrams.

This post offers tremendous scope for a skilled engineer who requires to gain further experience in the switchgear and motor fields.

Please apply to
The Personnel Manager, 49/50, Poland Street, London, W.1.

(A 641)

SOUTH EASTERN ELECTRICITY BOARD

FIRST ASSISTANT DISTRICT ENGINEER
GUILDFORD DISTRICT

SALARY £1,190/£1,325 p.a. under N.J.B. Class F, Grade 5, with progression to Grade 4 (maximum salary £1,410) subject to satisfactory service. Superannuable. Consideration will be given to a car allowance and assistance with house purchase.

The successful applicant will assist the District Engineer in all the work of the Department and must have had a wide experience of all aspects of distribution engineering, in particular planning, construction and the control of staff. Applicants should be suitably qualified, preferably corporate members of the I.E.E. Guildford District is both urban and rural in character, with both underground and overhead networks up to 11 kV.

Applications, quoting ET, on forms from District Manager, Seeboard, Woodbridge Rd, Guildford, Surrey, by 31 May, 1961.

ASSISTANT DISTRICT ENGINEER
GUILDFORD DISTRICT

Salary: £1,040/£1,165 under N.J.B. Class F, Grade 7. Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of M.V. and 11 kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ET, on forms from District Manager, Seeboard, Woodbridge Rd, Guildford, Surrey, by 31 May, 1961.

GEORGE WRAY,
Secretary.
(A 652)

KENT COUNTY COUNCIL

ELECTRICAL ENGINEERING ASSISTANTS

REQUIRED with experience in the design of electrical installations in buildings. Salaries within scales £1,140/£1,310 and £1,310/£1,480 a year. Applications to be sent, together with particulars of qualifications, experience and salary expected, to the County Architect, Springfield, Maidstone. (A 550)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

SECOND ASSISTANT STATION CHEMIST
BRADFORD POWER STATION

APPLICATIONS are invited for the appointment as Second Assistant Station Chemist at Bradford Power Station.

Applicants should possess a Higher National Certificate in Chemistry and have had previous Power Station experience.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule A, Class G, Grade 11 (£825/£940 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 1 June, 1961. (A 671)

MIDDLESEX COUNTY COUNCIL

County Architect's Dept.

ELECTRICAL ENGINEERING ASSISTANT

APT. III, £1,005/£1,185 inclusive, required. Should have practical experience or knowledge of contractor's office, preparation of drawings and specification of wiring buildings. Established. Prescribed conditions. Application forms (s.a.e.) from County Architect, 1 Queen Anne's Gate, Bldgs, Dartmouth St, S.W.1, returnable by 6 June. (Quote G.306/ET). (A 672)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEER

APPLICATIONS are invited for the above position in the Board's Borough District at 15 Penrose St, S.E.17.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 9, £1,090 per annum, rising to £1,215 per annum, inclusive of London Allowance.

Applications stating age, qualifications and experience should be sent to the Manager at the above address within 14 days of the publication date of this notice. Please quote Ref.: PER/V/3259/T. (A 656)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT ESTABLISHMENTS OFFICER

REQUIRED in the Department of the Secretary at the Board's Headquarters Office, Love La, Liverpool 3.

Salary within the range £1,680/£1,800 per annum (Principal Assistant N.J.C. Grade 10).

Applicants should have had good experience in personnel administration, industrial negotiation, joint consultation and in the application generally of agreements relating to salaries, wages and conditions of service.

Practical experience in this field within the Electricity Supply Industry would be an advantage.

Appointment subject to medical examination. Pension Scheme.

Applications should be forwarded to the Establishments Officer at the above address.

Closing date: 1 June, 1961. (A 658)

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required by

A. H. HUNT (CAPACITORS) LTD.

Applicants should be of B.Sc. or H.N.C. level with at least three years' experience preferably in the capacitor industry. Canteen facilities available. All replies will be treated in strictest confidence. Apply in writing in first instance, giving brief details of experience to date, age and salary to:

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A. H. Hunt (Capacitors) Ltd.
Vulcan Way, New Addington, Croydon, Surrey

(A 622)

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Bletchley, Bucks.

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Candidates should have H.N.C. (Electrical) or equivalent and be experienced in Tendering and/or Contract work for electrical equipment. A good record of past achievements in this field may outweigh the need for H.N.C. qualifications. Salary will be commensurate with qualifications and experience.

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(A 604)

AN ELECTRONIC ENGINEER is required at the BP Research Centre, Sunbury-on-Thames, to work on the maintenance of a variety of electronic instruments and equipment, including mass, infra-red, emission and nmr spectrometers. He should preferably be aged between 25 and 35 with an Electrical Engineering or Physics degree or equivalent experience. This is a responsible post, and the right man should be able to develop improved designs where needed. Salary according to age, qualifications and experience. Non-contributory Pension Fund. Housing Scheme. Removal expenses and settling-in allowance payable in certain cases. Luncheon Club. Write giving full details and quoting reference H.5484 to Box 6662, c/o Hanway Hse, Clark's Pl, E.C.2. (A 618)

A VACANCY exists at London Brick Company's Clay Block Works at Warboys, Hunts, for a WORKS MAINTENANCE ELECTRICIAN. Applicants must be competent to maintain a.c. generating equipment, a.c. motors from ½ h.p. to 50 h.p., general lighting equipment and to carry out installation as and when required. House available near the works. Applications, in writing, should be made to the Personnel Manager, London Brick Co. Ltd., Stewartby, Bedford. (A 572)

AUTOMATIC Electrical Control Gear manufacturers require SENIOR and JUNIOR SALES ENGINEERS for London office. Applicants for Senior positions must have Sales experience. Junior Engineers will receive training as internal, then external Sales Engineers on progressive basis. Minimum desirable qualification H.N.C. (Elec.), but those studying for this will be considered. Apply: General Sales Manager, Lee Guinness Ltd., 25 Victoria St, S.W.1. (A 640)

CABLE ESTIMATOR required. State age and experience. — Wandleside Cable Works Ltd., 106 Garratt La, Wandsworth, S.W.18. (A 499)

COMMERCIAL SALES ENGINEER required by Merchants' Company for service in Singapore. Minimum qualification O.N.C. (either Elec. or Mech.); age about 25; bachelor preferred. Good salary, scale according to qualifications and experience; excellent prospects. Annual increments; provident fund; non-contributory pension scheme; free furnished accommodation; passage provided. Write, Box No. 2024, c/o Abbotts, Eastcheap, London E.C.3. (A 680)

CABLE JOINTERS required up to and including 33 kV. Good working conditions. Apply Box No. 8303, Electrical Times. (A 675)

ELECTRICAL ENGINEER, young, required by Consulting Engineers Piccadilly. H.N.C., some years' experience, and with interest in design and instrumentation of control panel. Commencing salary and bonus, about £1,000 p.a. Pensionable post. Write with full details to Box F.737, c/o Street, 110 Old Broad St, E.C.2. (A 629)

ELECTRICAL ENGINEERS required for Manchester and Midlands Area, with experience in all types of cable installations, End Equipment, etc. Good salary and prospects. Superannuation Scheme. Apply Box No. 8301, Electrical Times. (A 674)

ENGINEER (Senior Staff Appointment) for Electrical Contracting Department required. Must be familiar with medium to large industrial and commercial installation and be in possession of O.N.C. or equivalent, also having had practical experience. Permanent position with opportunity for advancement. Write giving details of age, experience and salary required in confidence to the Managing Director, Green and Smith Ltd., Albert Wks, Meadow La, Leeds 11. (A 620)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

ELECTRICAL SENIOR and JUNIOR ESTIMATING ENGINEERS. First-class situations open, large Electrical Company, London. Write age, experience, salary. Box No. 8305, Electrical Times. (A 676)

INSPECTING ENGINEER (Electrical) required by Consulting Engineers to operate from their Manchester (Didsbury) Office. Applicants should preferably be between 25 and 30 years of age and should have had a sound electrical engineering training which with subsequent experience should have included one or more of the following: protective relays, electrical instruments and metering, electric motors, low voltage switchgear and control equipment. Candidates must also possess Graduate Membership of the I.E.E. Salary and prospects would be commensurate with the character of the appointment and inquiries for application forms should be made in writing to Staff Appointments, Kennedy and Donkin, 813A Wilmslow Rd, Manchester 20. (A 619)

SENIOR ELECTRICAL CONTRACTING ENGINEER required, South Wales Area, deal with Contracts to final Accounts. Excellent opportunity. Write age, salary, experience. Box No. 8307, Electrical Times. (A 677)

STOREKEEPER wanted. Good conditions, Pension Scheme. Please give brief details of experience, age and present salary. Hallams (Electrical Contractors) Ltd., 143 Buxton Rd, Stockport, Cheshire. (A 642)

SUPERVISING ENGINEER required by electrical contractors experienced in handling contracts through all stages from inquiry to final invoice. Overseas experience an advantage, but successful applicant will be based in London. Salary: £1,200 per annum. Application with full details to Box No. 8297, Electrical Times. (A 621)

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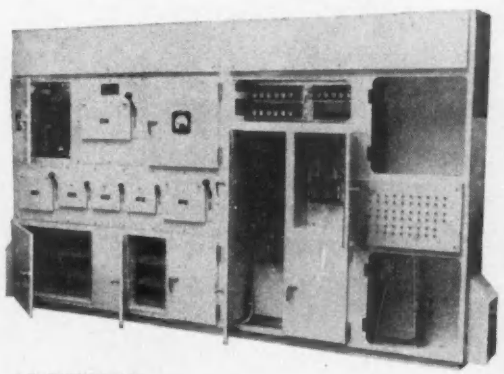

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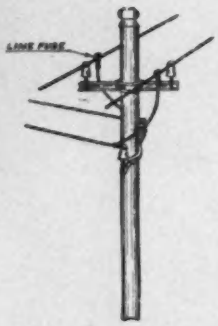

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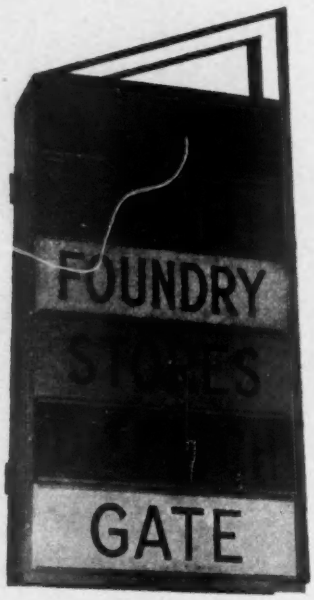

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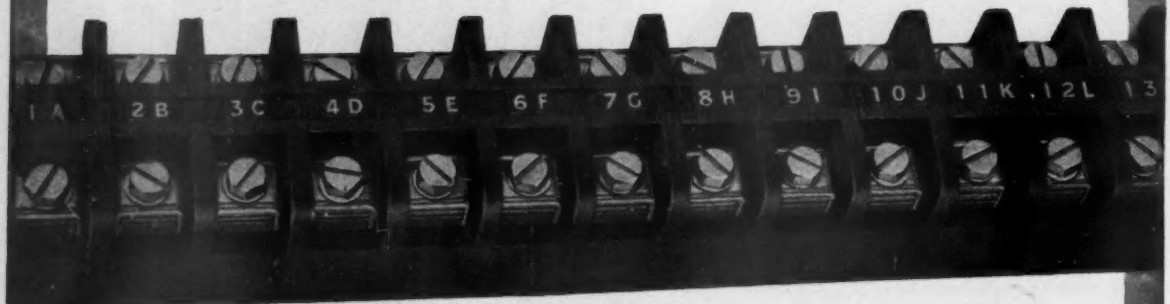

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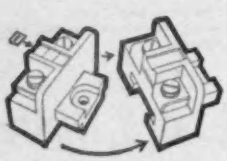

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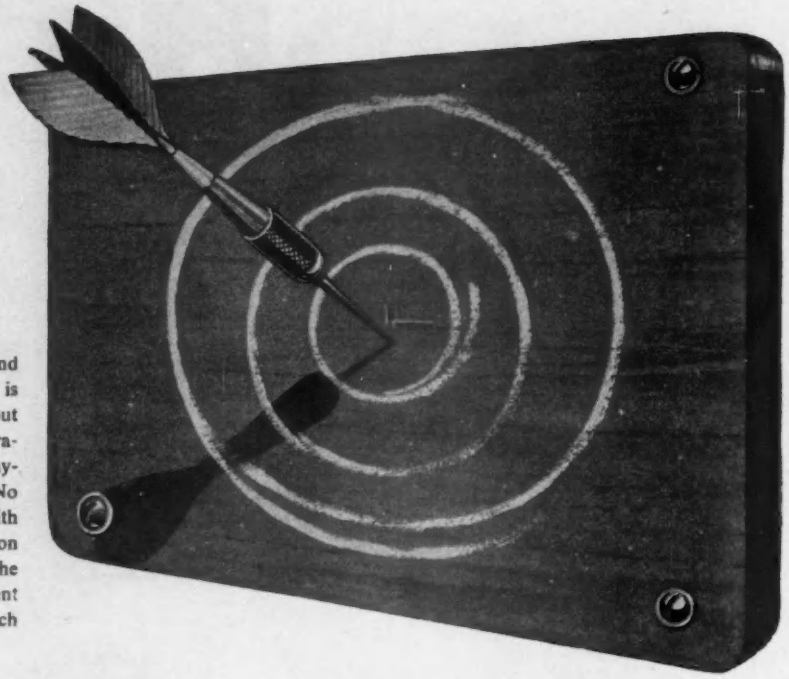

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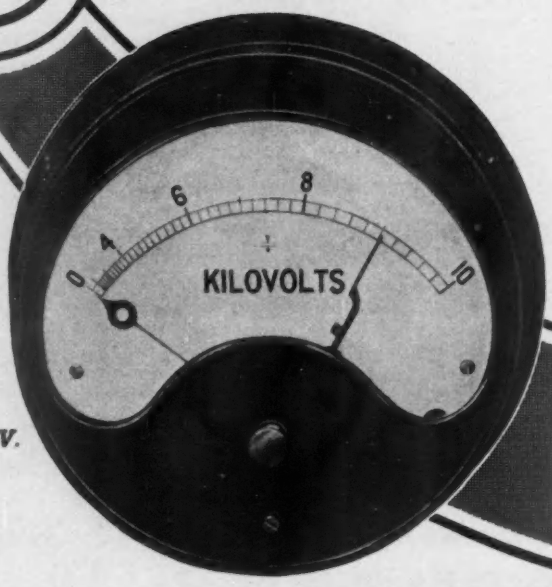

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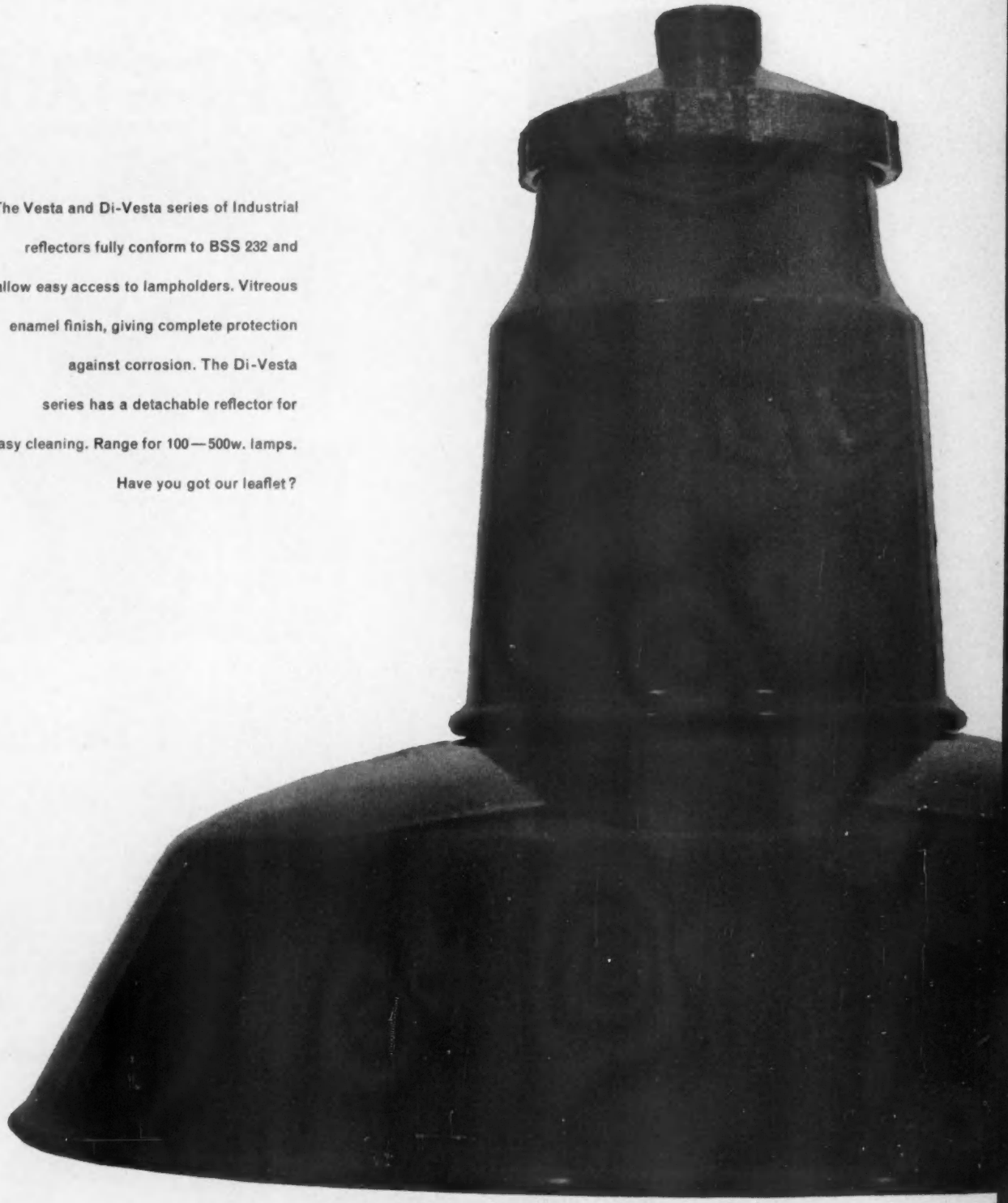

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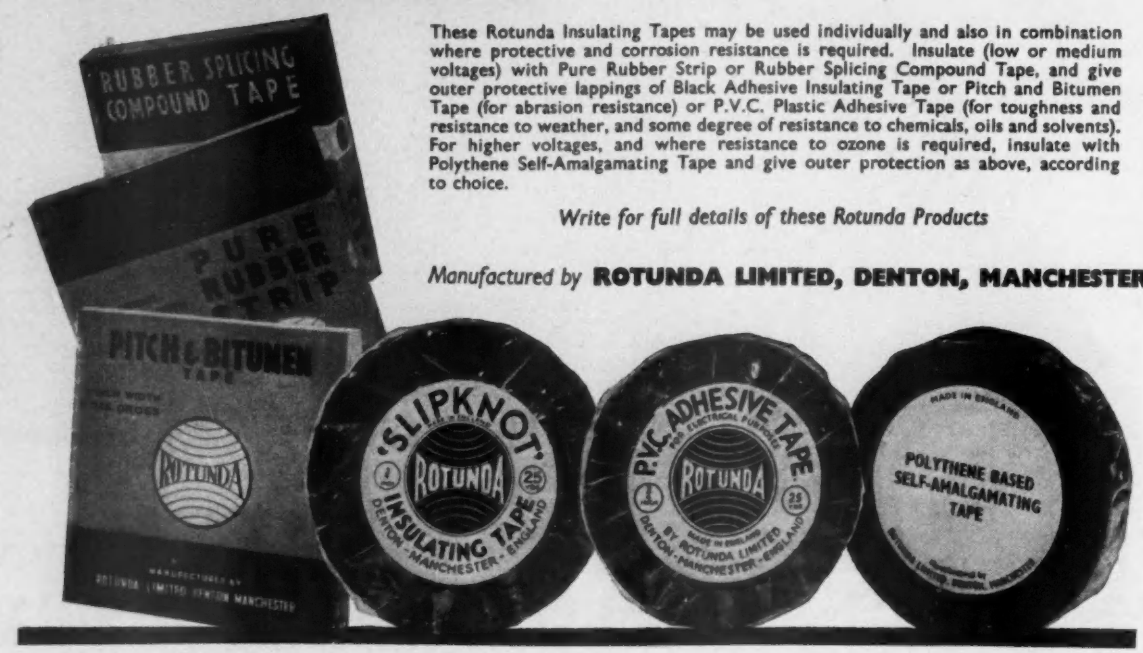

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The photograph on the right shows the rear view of the feeder section of the main switchboard, 69′ in length, manufactured by **Whipp & Bourne Ltd.** For this section and also the generator section, Bolton's supplied 21 tons of h.c. copper.

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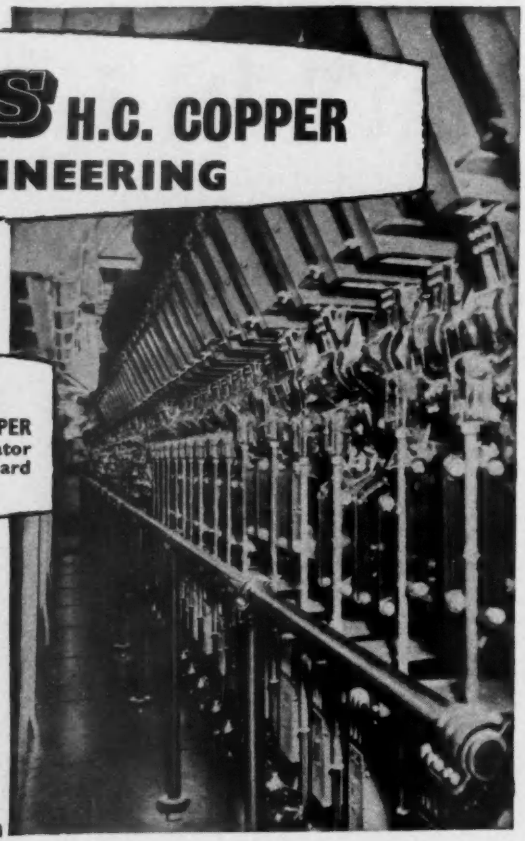

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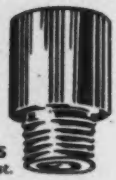
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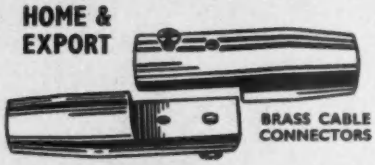
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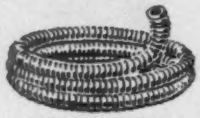
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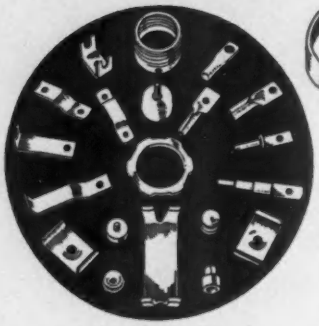
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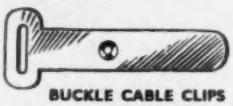
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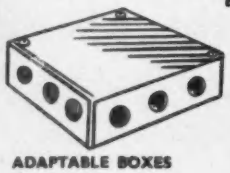
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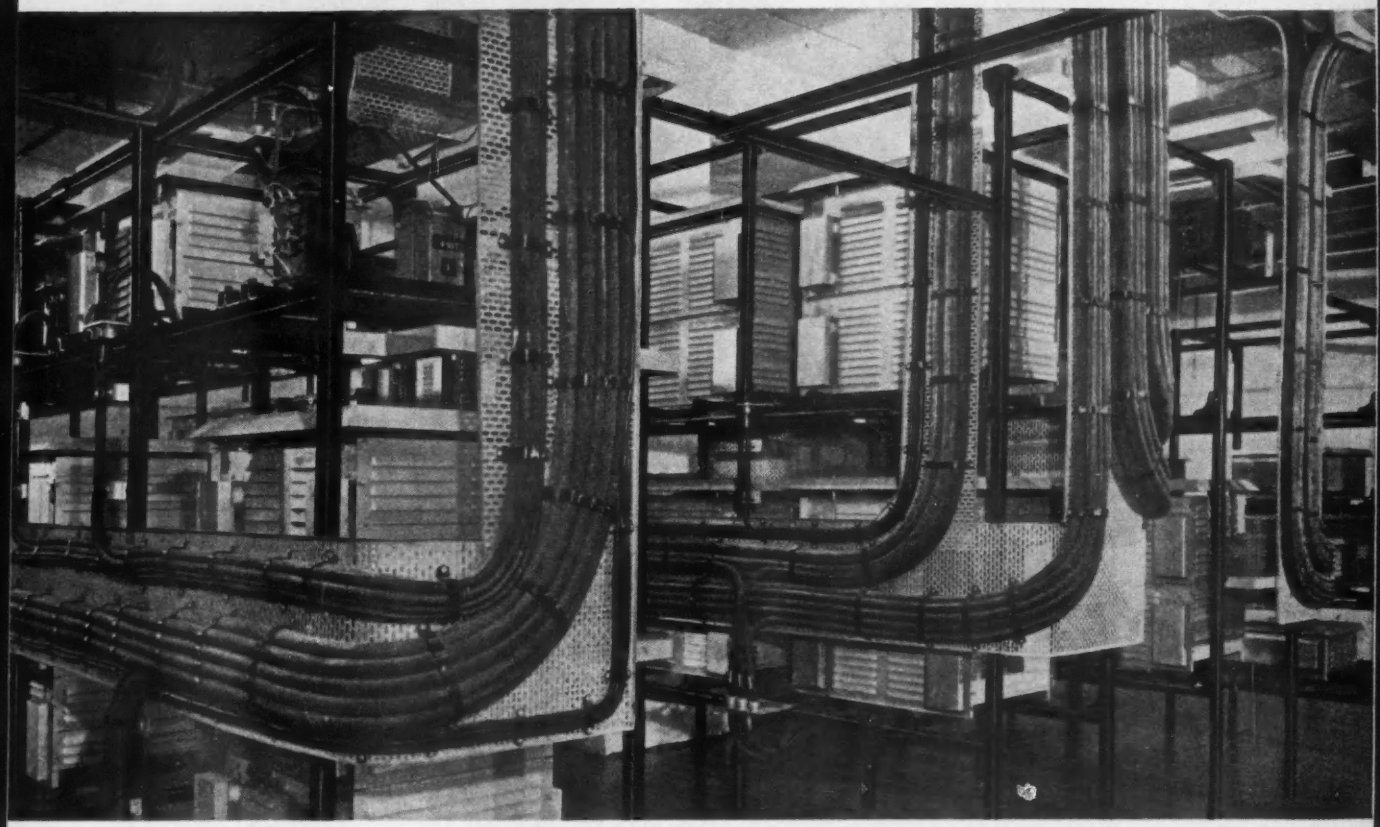

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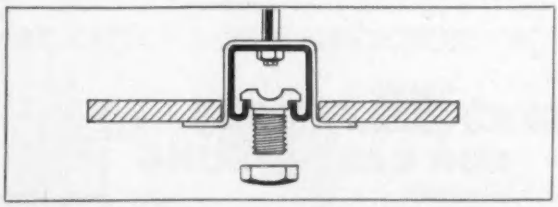

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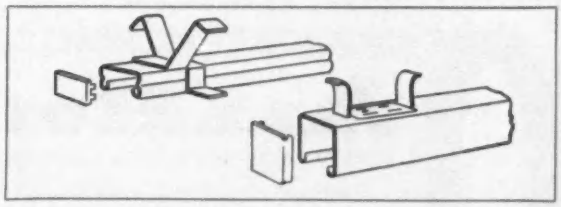

At Alcan, Unistrut concrete inserts were cast in flush to roofs and ceilings to provide attachment points for the main bus-bar support system, to which could be added supports for lubricating oil pipes, service mains and fluorescent lighting fittings. In walls, inserts hold the runs of electrical cables, whilst in floors they were used to locate switchboards.

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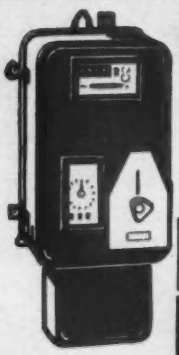

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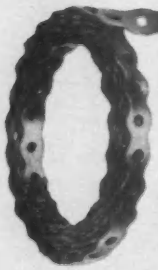

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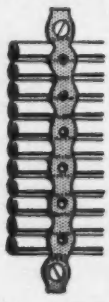

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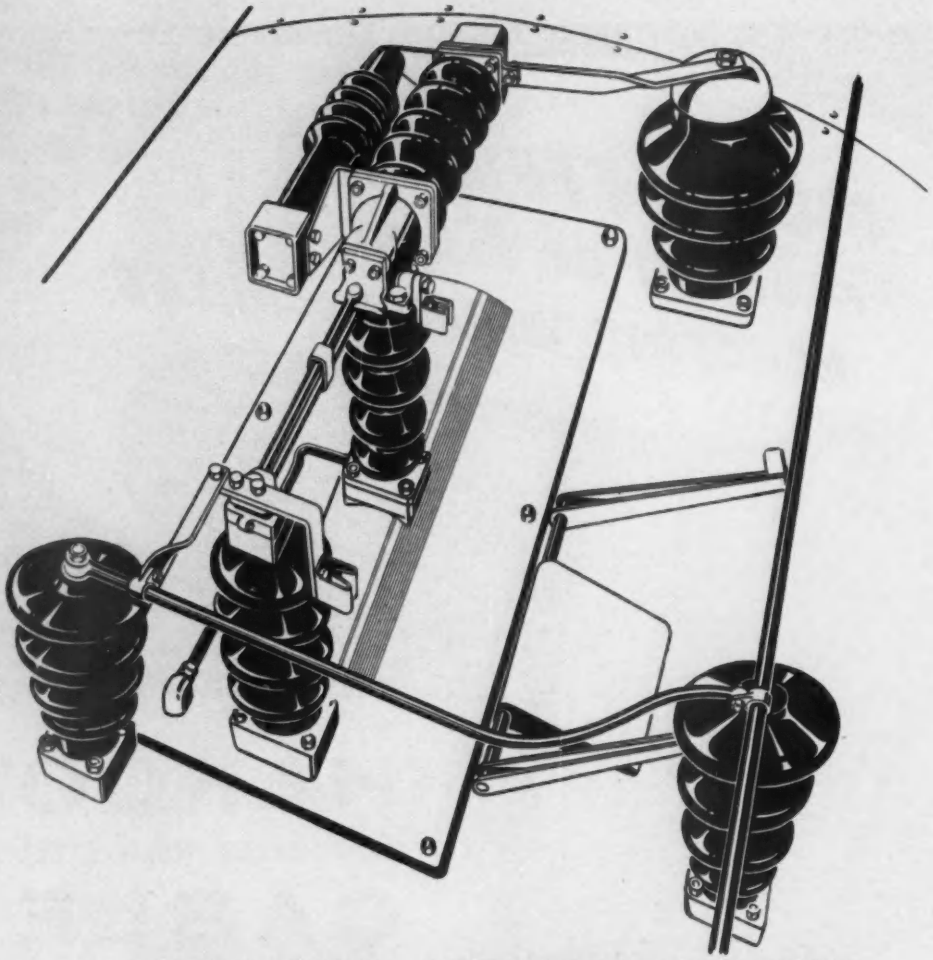

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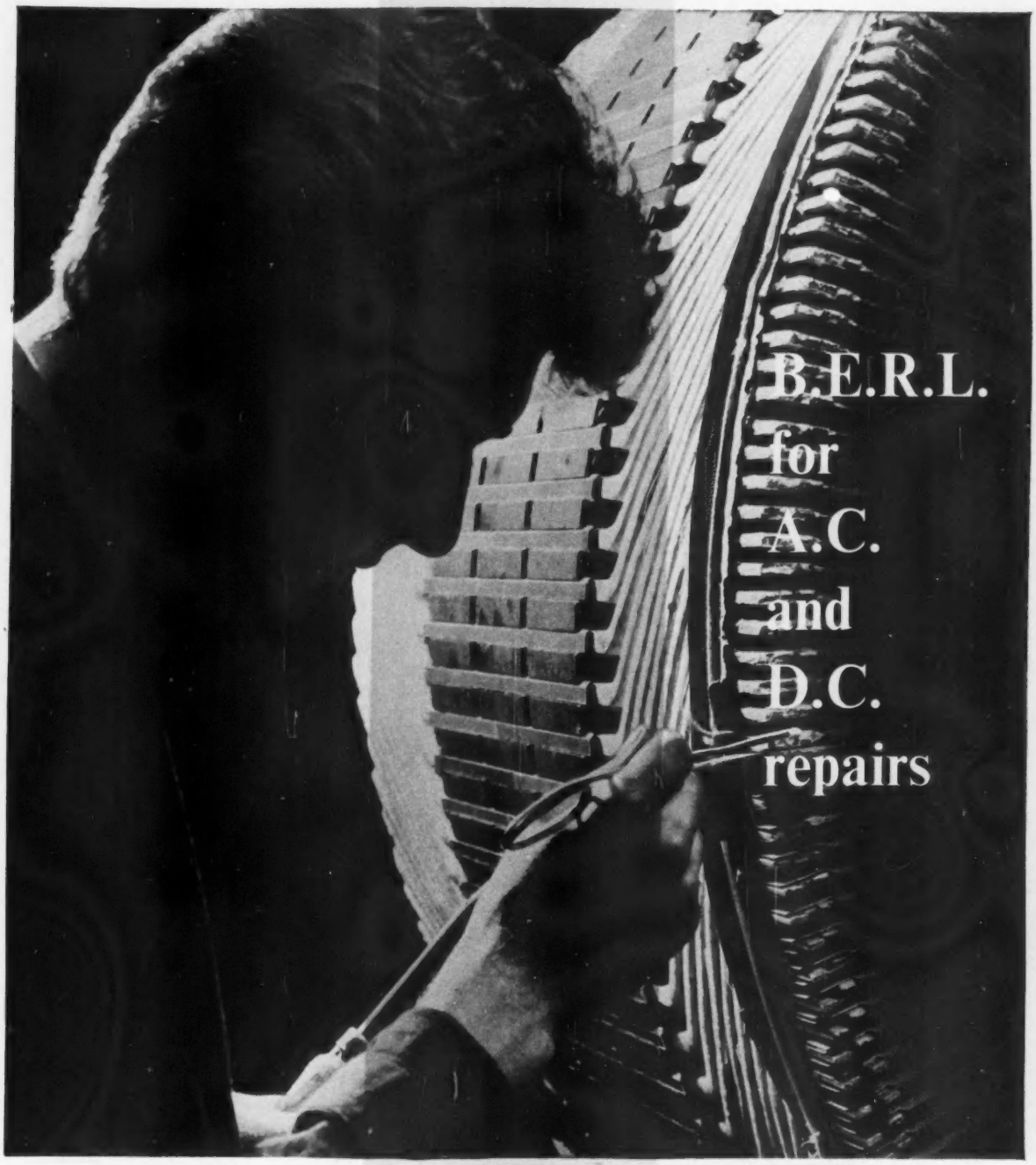

The illustration shows the soldering of the winding to commutator risers of a 1250 kW., D.C. generator armature.

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